EARLY
ARABIC PHARMACOLOGY

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AN INTRODUCTION BASED ON ANCIENT AND MEDIEVAL SOURCES

BY

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PREFACE

Studies in Arabic science are today, properly, still in the stage where the manuscripts must be constantly consulted, their contents minutely examined, and their factual data and values elucidated. Of the over 600,000 Arabic manuscripts dispersed in depositories throughout the world, relatively few have been studied for their scientific content, their origins, and their influence upon further work and development in the same areas.

It would, therefore, be presumptuous of any scholar to attempt to work out a synthesis of the scanty material available in print. As a result, it is absolutely essential, particularly in the study of Arabic science, that the manuscripts be held close at hand and one should not stray into well meaning generalizations and other types of statements which may later prove to be biased or unfounded. In this book, I shall present the facts as gleaned from the manuscript records themselves and from careful studies based only upon these.

Aside from the exact sciences, the most appropriate learned field in which one may follow an Arabic science historically is that of pharmacology. There is a variety of reasons for this. One is that the truth, of necessity, without the interposition of superstition, is urgently demanded in this area; that honesty in the drug trade, in pharmacology or in medicine was not always present does not affect this necessity. Further, because of the many extant manuscripts on pharmacology, it is easier in this area to derive the data required for comparison with Greek, Indian, Mesopotamian, Egyptian and works from other geographic locations from which many of the Arabic pharmacological ideas and drugs came. Third, the names of pharmacological products are subject to scientific etymological study *i.e.* botanonymic investigation correlated with the sources of these medicinal materials. This kind of examination may lead to a better understanding of the lines of transmission of pharmacological materials to the Arabs.

As the strongest fact-based biological science, Arabic pharmacology lasted into the nineteenth century. As a result of its accumulation of data from over thousands of years' experience, this science may still lead to something of value to modern workers in pharmacology.

Medicinal properties, particularly of botanicals known by Arab physicians and apothecaries, deserve greater attention than has been possible hitherto. Some important medicinal plants which are today prescribed by kavirajas (Vedic physicians) and hakims (Yunani physicians) of India have been explored as to their chemically active principles and pharmacological actions with success. More of this remains to be done. Some of the clues which may lead to potentially valuable drugs may be found in the early Arabic texts.

Because of the links among medicine, botany, zoology, chemistry, and pharmacology, a gathering of facts about the latter should eventually aid the understanding of all these fields of science in the ninth century and later.

In this work, lengthy biographical accounts and inconsequential anecdotes, contrary to the customary practice of almost all books on Arabic science, have been relegated either to complete omission or to brief mention. This kind of material should not be employed as a substitute for scientific data from the texts themselves.

Pharmacology, as used in this book, is the study of materia medica and therapeutics with special reference to ancient and medieval knowledge. It does not, of course, encompass such areas as pharmacognosy, pharmacodynamics, and other newer studies as known in the modern sense.

I should like to thank the Turkish Government, its library officials throughout that country, librarians in Cairo, Calcutta, Fez, Hyderabad, Leiden, Madras, Oxford (Bodleian), Patna, Rabat, Teheran, Tunis, and other depositories in various parts of the world for their generous assistance in the hunt for scientific manuscripts. I regret that I cannot give the names of these kind people nor those of others from whom I have learned much as drug sellers in bazaars all over the Middle East and North Africa and many hospital officials and physicians from Morocco to India. I am also deeply indebted to the scholars who have preceded me and to my contemporary colleagues. I have tried to mention them in the notes wherever possible. My inspiration, as ever, has been M. McG. L.

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CHAPTER ONE

PRE-ISLAMIC PHARMACOLOGY

ORIGINS OF MUSLIM PHARMACOLOGY

The Muslims made their appearance upon the world scene in the seventh and eighth centuries A.D. when, to their scientific and general cultural advantage, they encountered the literary and oral remains of the flowering of many great cultures which had preceded them, These were mainly those from Mesopotamia, India, Persia, Greece, and North Africa including Egypt. The authorities on drugs, because of the new avenues of trade and travel grew replete with information from many sources so that greater organization of this knowledge and its selectivity was forced upon them. This choice helped to accentuate the development of pharmacology in the direction of furthering objectification and developing empiricism. The overwhelming evidence for this change will be brought out in this volume. In addition, time and time again, the physicians and apothecaries returned to their older literature to reform their ideas and to resolve difficulties both in the practise and theory of pharmacology.

In the rapid access of medical works to the new science, some of value was neglected, brushed aside, or made little use of. The rectification of this oversight is still going on today in many laboratories particularly in India where the active principles and values of botanicals, by means of modern methods, are being studied in detail. However, to evaluate the extent of the consideration of earlier pharmacology and the contribution of the impetus and cultivation by Islamic sources, it is necessary to examine its origins in the prior cultures already mentioned.

MESOPOTAMIAN SOURCES

The earliest literature relating to pharmacology is to be found in the Sumerian and Akkadian clay tablets written in the third, second, and first millennia B.C. Throwing light upon this subject are two major types of writings, 1. lexical lists, and 2. medical texts.

In the third millennium B.C., the Babylonians conquered the Sumerians of lower Mesopotamia. The former, who spoke a Semitic language, Akkadian, quickly took much of the Sumerian culture as their own. In order to ease the task of absorbing this new knowledge written in cuneiform, the Babylonians not only had to learn the many technical and other terms of Sumerian but they also found that the latter consisted of two dialects. Because of this language difficulty, lexicographical works were composed giving the Sumerian and Akkadian equivalents, and comparative lists of the Sumerian dialects, and many kinds of unilingual and bilingual lists of related objects, ideas, and grammatical phrases and sentences.[1] This list literature, the earliest lexicography known, was the first attempt at a written classification of knowledge.

For pharmacology, the most important lists categorized the then known plants and trees.[2] The botanicals were, of course, not grouped according to any morphological distinctions but according to a rough division based on their major uses as grasses, alkalis, cereals, flax, lupines, purgatives, poisons, dyes, narcotics, fruits, and gummy materials. Within these categories, not mutually exclusive, often there were other criteria used to list certain plants together as appearance, thorny structure, and others.

As an example of nomenclature by appearance, there is the case of the cucumber, Sumerian *UKUŠ.ŠAR*. There is also the poppy, Sumerian *UKUŠ.RIM*, *UKUŠ.TI.GIL.LA* for colocynth, and *UKUŠ.TI.GI.LI.KUR.RA*, the squirting cucumber. There are other cases of *UKUŠ* botanicals but, in general, the word indicates a long ellipsoidal appearance. In the lists, usually called the lexical tablets, the Sumerian was often given alongside the Akkadian equivalent, very frequently taken over as a loanword, and when possible as a translation. In Akkadian, the cucumber found in a lexical list beside *UKUŠ.ŠAR* is *qiš-šu-ū*, the poppy is *ir-ru-u*, the colocynth is *tigillū*, and the squirting cucumber is *ḫil balti šadī*.[3]

[1] M. Levey, *Chemistry and Chemical Technology in Ancient Mesopotamia* (Amsterdam, 1959) pp. 6 ff.

[2] M. Levey, "Some Facets of Medieval Arabic Pharmacology," *Transactions and Studies of the College of Physicians of Philadelphia, 30,* 157 ff. (1963).

[3] R.C. Thompson, *A Dictionary of Assyrian Botany* (London, 1949) pp. 81 ff., 223. *Cf. Kuyunjik Collection, British Museum,* 4180, 4354; H. Rawlinson, *Cuneiform Inscriptions of Western Asia,* II, 44; L. Matouš, *Die Lexikalischen Tafelserien der Babylonier und Assyrer in den Berliner Museen,* I, 86; *Cuneiform Texts from Babylonian Tablets etc. in the British Museum,* 37, 108859, iv.

In the poppy, the capsules are in the shape of an ellipsoid. The word *UKUŠ* also refers to a stringed instrument, probably because of the shape of the ancient lute's sound chamber.

Then there is the Akkadian *ašagu* or Sumerian *Ú.GIR*, meaning thorn in general. The term is to be found in the compounded names for many plants. By itself, it indicates lycium; as *Ú.GIR.RIM*, it is the star-thistle; *šam ḫīl ašagi* is thorn gum.[1] The preceding "*šam*" is the determinative for plant. Other thorny plants are often grouped together in the plant syllabaries. Most of these plants are still unknown since their names are of insufficient descriptiveness.

The lexical lists give many hundreds of botanicals names, many of which have been identified by their uses given in other types of cuneiform texts, and in their applications in the medical texts. Philological extrapolation backward from the Arabic and other Semitic languages is of value in identification of Akkadian names of drugs; the same is true at times when the Akkadian is used in the determination of Arabic materia medica.

A short passage from a lexical list of botanicals will serve more concretely to give the reader an idea of its construction and study.

iṣ	*GEŠTIN*	*kar-ra-nu*
iṣ	*GEŠTIN.GIR*	*mur-di-nu*
iṣ	*GEŠTIN.KA*	*pil-lu-ú*
iṣ	*GEŠTIN.LUL.A.*	*ka-ra-an sē la-be*
iṣ	*GEŠTIN.ŠU.UŠ.RA*	*šušrû*
iṣ	*GEŠTIN.IGI.GUD*	*i-ni alpi*
iṣ	*GEŠTIN.ŠUR.RA*	*ṣa-aḫ-tu*
iṣ	*GEŠTIN.HA.PAR.A.*	*mu-zi-qu*
iṣ	*GEŠTIN.GAM.ME*	*ka-ra-la-nu*
iṣ	*GEŠTIN.GAM.ME*	*ta-ra-la(?)-nu*
iṣ	*GEŠTIN.GAM.ME*	*kip-pat (iṣ) karani*
iṣ	*GEŠTIN.GAM.ME*	*dil-lat (iṣ) karani*

[1] R.C. Thompson, *op cit.*, p. 181.

iṣ	*KIN.GEŠTIN*	*iš-ḫu-na-tu*
iṣ	*GA.GEŠTIN*	*iš-ḫu-na-tu*
iṣ	*GA.RA.AN GEŠTIN*	"
iṣ	*DIL.LA.GEŠTIN*	*dil-la-tu*
iṣ	*PA.PA.AL.GEŠTIN*	"
iṣ	*PA.PA.AL.GEŠTIN*	*pa-pa-al-lum*
iṣ	*PA.PA.AL.DU13.GEŠTIN*	*sil-lu*
iṣ	*AMA.GEŠTIN*	*um-mu*

A section on fruits follows here, continuing this particular lexical list. The list above has been taken from a much longer tabulation. However, this excerpt, as an example, will serve to show how the material has been studied and utilized.[1]

The determinative *iṣ* signifies a tree or vine. However, the word *GEŠTIN* and other words were frequently used without it. The Sum. *GEŠTIN* and the Akk. synonym *karamu* signify the grape vine or wine;[2] the latter was often used as a vehicle for drugs and as a medium in which to steep drugs [3] at room temperature. Various words compounded with *GEŠTIN* give the meaning "strong wine," "pressed grapes," "vinegar," "strong vinegar," and others. The Akk. *kililanu* may be cognate to Heb. *kĕlīlā* "crown," and may be related to Akk. *kilili*, associated with the convolvulus, perhaps scammony. Further, Akk. *dillatu* may be the Syr. *dālītha*, palmites [4] and is related to *DILLA* in the lexical list given.

Also, *ᵗᵢGEŠTIN.GIR.RA*, or Akk. *(a)murdi(n)nu*, may be the bramble or rose. The Akkadian may be the Arabic *warad*. The Sum. means "vine thorn.[5]"

[1] *Cuneiform Texts... in the British Museum, XIV*, plates 10, 18 ff; *XXXVII*, plates 28-32; L. Matouš, *op. cit.*, vol I, *Gegenstandslisten* 88, 90. P. Jenson, E. Schröder, ed., *Keilinschriftliche Bibliothek* (Berlin, 1892) Vol. III, 1; R.C. Thompson, "Vade Mecum", *Journal Royal Asiatic Society* (1934) 781.

[2] *Cf.* B. Meissner, *Mitt. d. Vorderasiat. Gesell.*, 2, 32 (1913).

[3] The most common method of obtaining the drugs from botanicals (leaf, root, bark, etc.) in classical Arabic times was to leave the desired part of the plant in water for a certain time. This was then given to the patient. This is still a very common practice in Yunani medicine in India today. At the end of every ward, there is a table laden with beakers containing infusions prescribed for the sick.

[4] I. Loew, *Die Flora der Juden* (Wien, 1924-1934) vol. I, p. 68.

[5] P. Jensen, *op. cit.*, vol. VI, 516. *Murdinnu* is the name of a head or eye disease (*Cuneiform Texts*, XXIII, 23, 2; R.C. Thompson, *op. cit.*, 331).

The eggplant, *ᵗᵢGEŠTIN.KA* corresponding to Akk. *pi-lu-ū* in a lexical list [1] may be confused with mandrake since the word *pilū* (meaning "egg") is used for it. This *pilū* is probably cognate to the Ar. *luffāḥ* by metathesis and to the Syr. *pāḥelāthā* (meaning "testicles"). The Syriac is the clue to the fact that the Ar. *luffāḥ* also has the meaning of eggplant. Budge [2] translated the Syriac description of the mandrake (the *kahīnā* plant), "on the top thereof two little balls which are like the testicles of a man." The Sum. *GEŠTIN* is part of the word for eggplant since its meaning of "grape" is pertinent to the form of the latter. The attached *KA* as "brown" fits, however, with *ᵃᵇᵃⁿKA* "iron oxide".

The Akk. *šušru* may be conjectured as the Syr. *šaḥšūrā*, the mandrake.[3] *Šušru* is a loan word from the Sumerian, as may be seen in the lexical list given above.

In the furtherance of study of the nomenclature of Arabic botanicals and chemicals, there can be no doubt but that the greater understanding of the ancient Mesopotamian technical terms can be of the greatest assistance, and vice versa.

In the Mesopotamia of the third millennium B.C., the medical men may not have given up the wearing of botanicals and other objects in amulets to cure disease but, as may be seen in the medical texts, there was a strong belief in the value of many kinds of drugs, plant, mineral, and animal, to combat illness. As a result, the Sumerian as well as the later Akkadian cuneiform tablets portray a wide range of pharmacological practice. The oldest medical tablet known is of the 22nd century B.C. and is in Sumerian. Its materia medica is of interest in spite of the fact that the name of the disease for which the prescriptions are given is not known.[4] Some of these prescriptions read as follows:

"Pulverize... [and] river clay *[SAḪAR.ḪIG.ÍD.DA];* knead it with water [and] honey; let sea oil *[IÀ.ENGUR]* and hot [?] cedar oil *[IÀ.NE.ÉRIN]* be spread over it."

"Pulverize dried apple and the 'moon' plant [perhaps a *Menisper-*

[1] Of Ras Shamra, F. Thureau Dangin, *Syria*, pl. XLVI (1931).

[2] E.A.W. Budge, *The Syriac Book of Medicine* (London, 1913) vol. II, 708.

[3] I. Loew, *op. cit.*, vol. III, p. 367.

[4] M. Levey, *Chemistry and Chemical Technology in Ancient Mesopotamia*, pp. 147 ff.

mum species]; infuse it with *kushumma* wine *[KU.ŠUM.MA.GEŠTIN]*. Let tree oil *[IÀ.GIŠ]* and hot [?] cedar oil be spread over it."

"Pulverize the seed of the 'carpenter' plant *[NUMUN.NÍG.NAGAR. SAR]* [perhaps *Gymnosporia serrata* Loes], the gum resin of the *markazi* plant *[ŠIM.MAR.KA.ZI]*, [and] thyme *[Ú ḪA.ŠU.AN.UM]*. Dissolve it in beer and let the man drink."

"Apportion... turtle shell *[BAR.NÍG.BÚN.NA]*, horned alkali *[TÈ.SI.SAR.] [Salicornia fruticosa* L.*]*, salt *[MUN]*, cassia *[GAZI]*. Knead them together with powdered asafetida *[AŠ.ZI]*; wash them in high quality beer [and] boiling water. Sprinkle all the solution upon it [*i.e.* the ailing organ]. Rub tree oil over it and let pulverized fir cones *[GIŠ Ú.KU]* be added."

"Purify [and] pulverize the [skin of a] water snake *[MUŠ.A.]*. Pour water over the *AMA.MAŠ.DUB.KAŠ.KAL* plant, the root of myrtle *[GIŠ.GIR]*. pulverized alkali *[TÈ]*, barley *[ŠE]*, and powdered fir resin *[KU.SI.IB.ḪU]*. Boil and then let its liquid be decanted. Wash [the ailing organ] with the liquid. Rub tree oil on it. Let *ŠAKI* be added."

"Purify and pulverize the... of a cow *[LUḪŠU.ŠA.GA.AB]*. Pour water [over] a branch of myrtle, a 'star' plant, the root of the *AB* tree [perhaps *Commiphora opobalsamum* Engl.], dried apple *[GIŠ ḪAŠḪUR.ḪAD]* and *IB* salt *[MUN.IB₂]*. Boil and let its liquid be filtered. Wash it with the filtrate and let potassium nitrate *[NE]* [and] the... plant *Ú Azi* be added."

From this series of prescriptions, it is evident that the drugs come from the three kingdoms. The largest group, however, is botanical in origin utilizing the seed *[NUMUN]*, gum resin *[ŠIM]*, root *[E.BUN. NA]*, tip or twig *(PA)*, wood *(GIŠ)*, and bark *(BAR)*. Various oils are also mentioned as cassia and cedar extracts, for example. In order to obtain these as well as the other materia medica mentioned, it must be understood that the ancient Mesopotamians already had a wide knowledge of chemical operations and were able to carry out elaborate procedures.[1] This will be demonstrated before the discussion on ancient Mesopotamian pharmacology is completed.

The directions for the preparation of simple and compound drugs in this oldest pharmacological tablet are very brief when given at

[1] R. Campbell Thompson, *Ambix 2*, 3-16 (1946).

all. Aqueous and oil extracts as well as wine of sesame infusions are mentioned. These had to be purified first before use. The directions usually say "Purify and pulverize..." but this simple phrase involves much in the way of knowledge and operations. A good example is that of potassium nitrate which is employed in one prescription. In ancient times, the Indians and Assyrians probably collected the crystalline formations which were found in surface drains in which nitrogenous waste products, as urine, flowed. The likeliest method of purification would have been a separation of the various salts and other substances by the process of fractional crystallization.[1] In the Middle East, a very old process is still used of mixing lime or old mortar with decomposing nitrogenous organic matter to form calcium nitrate which is then lixiviated and boiled with wood ash containing potassium carbonate to yield nitre on evaporation of the mixture.[2]

In early times, beer was probably the most common vehicle for drugs to be administered orally. The Sumerian and later Akkadian texts bear this out. Interestingly enough, beer was also used with water for drugs to be employed externally.[3] The text translated above from the Sumerian also shows the importance that the Sumerians attached to the use of odoriferous principles found in the botanical kingdom.

Although the prescriptions seem to have little of a therapeutic value, they, nevertheless, include simples which may have had some effect, as salt as an antiseptic,[4] potassium nitrate as an astringent, and vegetable honey as a disinfectant and styptic.

It should be noted that this old text does not prescribe the dosage and frequency. Nor are the quantities of the involved materia medica given.

The Sumerians, by 2200 B.C., had built up a pharmacopoeia based on a strong chemical technology. In the prescriptions, there is no hint of irrational elements being used. The text is unique in that it depicts a completely objective pharmacology and chemistry. This work, depending on the use of drugs, represents a forerunner of the

[1] J.R. Partington, *A Textbook of Inorganic Chemistry* (London, 1950) p. 702.

[2] R. Campbell Thompson, *Journal Royal Asiatic Society* (1937) 421.

[3] M. Levey, *Chemistry and Chemical Technology in Ancient Mesopotamia*, p. 153.

[4] Infusion of the bark and leaves of willow is rich in strongly antiseptic salicin. The text seems to have used the wood.

non-manipulative and non-operational therapy so dominant in Mesopotamian medicine. In Egypt, on the contrary, the contemporary practice was more along surgical lines.

In drugs and in pharmacology, the empirical approach was already at work in the third millennium. In spite of the many superstitious traditions still operating in full force, an objective science of medicine had made a healthy beginning.

In order to round off this brief discussion of ancient Mesopotamian drug identification and pharmacology, it may be in order to recall some Akkadian texts on perfumery.[1]

Aromata were indispensible items in the Mesopotamian and Arabic pharmacopoeias. The preparatory operations for these materials were extensive as may be seen from the following technological description.[2]

"If you prepare flowers, oil, and calamus as a salve, and you have tested the flowers [of the calamus and its green parts], you set up... a distillatory. You put good potable water ... [into a *ḫariu* pot]. You heat *tabilu* and put it in. You put 1 *qa ḫamimu*, 1 *qa iaruttu*, 1 *qa* [3] of good, filtered myrrh into the *ḫariu* pot. Your standard in this is the water taken and divided. You operate at the end of the day and the evening. It remains overnight. It becomes steeped. You filter this solution ... with a filter cloth into a *ḫirsu* pot at dawn, on the rising of the sun. You clarify from this *ḫirsu* pot into another *ḫirsu* pot. You discard the residue. You use 3 *qa* of purified *Cyperus* [4] in the solution with the aromatics. Discard the inferior material. You put 3 *qa* myrrh, 2 *qa* pressed and filtered calamus in the solution with these aromatics in a *ḫirsu* pot. You measure 40 *qa* of this solution which remained overnight with the aromatics ... 1½ pure *gullu* ... two beakers... ... small beakers ... You filter ... *kanāktu* in a sieve. You decant oil in the *ḫariu* pot ... in the solution. [You rub that which was with the solution overnight.] [You examine] the comminuted material. You remove [its bad part]. You filter this solution which [you clarified into a distillatory] ... 3 *qa* ... [You throw] ... balsam into this solution in [a *ḫirsu* pot]. [You kindle a fire]. When the solution is heated for admixture, [you pour in the oil]. You agitate with a

[1] M. Levey, *Chymia, 6*, 11-19 (1960); also M. Levey, *Chymia, 6*, 20-26 (1960).

[2] M. Levey, *Chymia 6*, 15-16 (1960).

[3] About 1/2 liter.

[4] Species unknown.

stirrer. [When the oil, solution, and aromatics] continue to dissolve, [you raise] the fire ... You cover the distillatory on top. [You cool] with [water]. When the sun [rises], [you prepare] a [container for] the oil, solution, and aromatics. You allow the fire under the distillatory to die down. You remove the distilled and sublimed substances from [the trough of the distillatory...].

"When the sun [rises], [if] they continue to dissolve in one another and [the fire rises], you cover the [top] of the distillatory. You cool. You prepare a flask for the calamus oil. You put a filter cloth over the flask. You filter the oil with a filter cloth into the flask. You remove the dregs and residue left in the distillatory.

"This is the preparation of flowers, oil, and calamus for [salve] for the king according to the recipe of Tappūti-Bēlatēkallim, the perfumeress.[1]

"The twentieth of *Muḫur-ilani, Limmu* of *Qatnu-qardu*.[2]"

In the Greek, Syriac, Hebrew, and Aramaic, intervening between the Akkadian and Arabic literatures, there is much less material on chemical technology. One of the conclusions must be, therefore, that this kind of knowledge, from metallurgy, glass making, tanning, dyeing, papermaking, and others down to the preparation of materia medica, was transmitted mainly in an oral fashion, from master to apprentice, or from father to son. In this way, many of the fine distinctions given in the Akkadian and Sumerian lexical lists were lost to the corpus of the classical Arabic materia medica literature.

Much, however, of the materia medica and its preparation was similar in Babylonian and in early Muslim times. The most notable difference is associated with the development of alchemy in Alexandria. The processes of ceration, combination, coagulation, and amalgamation as used in alchemy were not known in ancient Mesopotamian chemistry or pharmacy.

For a better understanding of Muslim pharmacology, it is of value to explore its forerunners in the great civilizations of the classical and ancient world. In these antecedents, there were not the static conditions of culture so often mentioned in history books. Scientific change was carried on although, at times, it did not coincide in rate

[1] The earliest chemist known by name is thus a woman.

[2] This gives the date as about 1200 B.C. since the *Limmu* or head official who regulated the calendar was changed every year.

in different fields or even resemble that of the modern period. It was, nevertheless, a slow, stubborn process, partly empirical and in part theoretical. In the interactions of the pre-Islamic cultures among themselves and then finally their effect on the Muslims, is to be found some of the reason for the Arabic seminal ideas and scientific growth of 800-1100 A.D.

Indian Pharmacology

Beginning in pre-Islamic times and throughout the medieval period, the influence of Indian medicine was at work on the oral and written literature of the Arabs. Not only did the Arabs have broad commercial contacts in India, (and as far as China) but the later Persian and Arab scholars knew well their Indian medieval contemporaries in Baghdad. In the early part of the Abbasid period (8th cent.) the Muslim world already possessed Arabic translations, to a large extent, through the Persian from the Sanskrit of ancient medical treatises.

To appreciate this influence correctly, it is first necessary to turn back to the zenith of ancient Indian medicine and relate its major points in Susruta and Charaka. Together with Vāgbhaṭa I, they composed the "triad of ancients" *(vriddha-trayi)*. Very few new elements were added to Indian medicine after these.

Susruta,[1] a surgeon, was probably a younger contemporary of Ātreya's pupil, Agnivesa, most likely of the sixth century B.C. The Kashmiri physician Charaka [2] probably lived in the second century A.D. Vāgbhaṭa I probably flourished in the late sixth or early seventh century of this era.

Indian medicine began with the Indus Valley civilization, and was contemporary with the Sumer-Akkadian and ancient Egyptian societies between 2500 and 1500 B.C. Insufficient evidence in the artifacts and incomplete decipherment of the inscriptions found at Harappā, Mohenjodāro and Chanhu-dāro, near the Indus, make difficult a satisfactory medical understanding of this early period. Down to the sixth century B.C., there is little in medicine which had

[1] *Cf.* ed. of A.C. Kaviratna, *Charaka Saṃhitā* (Calcutta, 1890-1910).

[2] K.J. Bhishagratna, *Susruta Saṃhitā* (Calcutta, 1907-1925), abbreviation = *Susruta;* M. Neuberger, *Gesch. d. Medizin* (Stuttgart, 1906) p. 176; ibn abī Uṣaibi'a, *Kitāb 'uyūn al-anbā' fī ṭabaqāt al-aṭibbā'* (Koenigsberg, 1884).

an effect on the later Muslims, directly or indirectly. However, it was in this century that the medical schools of Ātreya and Dhanvantari [1] were founded.

The period just prior to this, 800-600 B.C., that of the Brāhmanas and the Upanishads, was one of great intellectual ferment which, among its accomplishments, led medicine from a magico-religious to an empirico-rational basis in India. The spiritual revolt gave rise to the establishement of new religions, Jainism and Buddhism, and led to new philosophical movements. The latter, as new systems of thought, became allied with or affected the new medicine in many ways. The great Susruta was a product of this new learning. Medicine and surgery, coming respectively from Ātreya and Susruta, spread rapidly in their own divisions down to the Arabic period.[2]

The two most important works of ancient Indian medicine, the *Charaka* and *Susruta Saṃhitās*, both preserve much of the prior oral medical literature of many centuries, and perhaps that of a millennium earlier. Both works are difficult to use since their divisions are not mutually exclusive and there is much rambling and repetition throughout. Not only is the authorship in doubt in both cases but both certainly contain many later accretions and extraneous material. Both of these texts are vast encyclopedias and must have offered much of enormous interest later on to the Christian, Jewish and Persian physicians of the Islamic period.

In regard to pharmacology, the Charaka and Susruta texts served to introduce to early Muslim medicine hundreds of Indian drugs, their methods of preparation, and uses in therapy. For over a thousand years, until the 19th century, these drugs remained among the materia medica of many advanced cultures.[3]

Before giving some small portions of Susruta and Charaka as examples, it may be of value to discuss briefly the ideas which gave rise to their pharmacology. One may begin with the *panchabhūtas* or five elements : earth, air, fire, water, and ether. These give rise to three

[1] P. Katumbiah, *Ancient Indian Medicine* (Bambay, 1962) p. XV.

[2] H.R. Zimmer, *Hindu Medicine* (Baltimore, 1948); A.F.R. Hoernle, *Medicine of Ancient India* (Oxford, 1907); J. Jolly, *Indian Medicine,* translated by C.G. Kashikar (Poona, 1951).

[3] For a brief, general account of ancient Indian materia medica and also the medical ideas relating to their use, *cf.* P. Kutumbiah, *op. cit.*, chapter VI.

humors *(doṣas)*, air *(vāyu)*, bile *(pitta)*, and phlegm *(kapha)*. The humors together with the seven tissue constituents *(dhātus)* make up the body. In health, there is an equilibrium of the tissue constituents. In illness, when the humors are disturbed, they act on the tissues of the body to produce disease. To return one to health, the humors must be brought back to their normal state by diet, drugs, and proper regimen.

Within the context of these beliefs, pharmacology held its place. Drugs in Susruta [1] are divided into thirty-seven categories according to their therapeutic properties; he orders that "An intelligent physician should prepare plasters, decoctions, medical oils, medicated ghees, or potions according to the exigencies of each individual case. The various categories should be therapeutically used according to the nature of the deranged humors involved in each individual case. Only two, three, or four drugs of the same medicinal group, or a similar number of drugs chosen from the different groups, or a group of medicinal drugs in its entirety, or in combination with another, should be used according to the indications of any particular case, as the physician, in his discretion, would determine."

An important classification of drugs in Susruta is given according to taste : acidic, saline, pungent, bitter, astringent, and the *madhura* group, usually sweet, composed largely of ghee, lard, marrow, pulse, and others whose Hindi names are difficult to translate.[2] The text relates that when different drugs are taken in a variety of combinations, then sixty-three of these are possible. "The man, who gradually habituates himself to the use of each of the six aforesaid tastes, enjoys a sort of immunity from their injurious action in the same manner as a strong man, who makes himself successively accustomed to the action of the three deranged humors of his body, is not easily affected by their pathogenic properties."

Although Susruta was primarily a surgeon, he gave much emphasis to therapeutics by drugs in his *Chikitsā-Sthānam*. A typical example is the therapy described for the *uru-stambha* disease.

"The deranged air surcharged with the local fat and phlegm gives rise to a swelling in the region of the thigh which is known as *uru-stambha;* others designate it as *ādhya-vāta*. This disease is marked by

[1] *Susruta, op. cit.*, I, chapter 38, p. 342.

[2] *Ibid.*, I, pp. 390-393.

lassitude and an aching pain in the limbs, by the presence of fever, horripilation and somnolence, and by a sensation of coldness, numbness, heaviness, and unsteadiness in the thighs, which seem foreign to the body.

"Its treatment. The patient should be made to drink a potion consisting of the pulverized compound known as *shad dhārana-yoga;* or of drugs constituting the *pippallyādi* group dissolved in hot water without using any oleaginous substance; or a lambative, composed of pulverized *triphalā* [1] and *kaṭuka* mixed with honey, should be used; or a potion, consisting of *guggulu* or *sīlājatu* dissolved in cow's urine should be administered. These compounds subdue the aggravated air surcharged with deranged fat and phlegm and prove curative in heart disease, an aversion to food, abdominal tumors, and internal abcesses. A medicinal plaster composed of *karanja* fruits and mustard seeds, pasted with a copious quantity of cow's urine should be applied hot to the affected part, which may be as well fomented with cow's urine mixed with alkali; or the locality should be shampooed with articles devoid of any oily substance. The diet of the patient should consist of ... The use of oil and lardaceous substances in general should, however, be prescribed after the deranged fat and phlegm have subsided.[2]"

According to Charaka, all substances were potentially materia medica if they were applied properly for specific purposes.[3] Further, Charaka states in the *Kalpa-sthāna*,[4] a chapter in *The Charaka Saṃhitā* :[5]

"Taking into consideration that drugs differ with respect to land, season, source, flavor, taste, potency, post digestive effect, and specification and also that men differ with respect to their body, morbid tendency, constitution, age, vitality, gastric fire, proclivities, homologation, and stage of disease, we shall here describe 600 purgative preparations that are pleasant in their variety of smell, color, taste, and touch of drugs, although the number of possible preparations from these drugs is enormous."

[1] Includes the *haritaki, āmlaki,* and *vibhitaka* drugs (Susruta I, p. 353).

[2] *Ibid.*, II, pp. 313-314.

[3] P. Kutumbiah, *op. cit.*, p. 110.

[4] *Charaka*, I, pp. 1-6.

[5] Shree Gulabkumverba Ayurvedic Society (Jamnager, 1949) I, p. 325. Abbreviation = *Charaka*.

The secret of drugs is in their being prepared for use.

"Preparation is the process performed to modify the natural properties of substances. That process again is that which modifies radically the properties of substances. This modification is brought about by dilution, application of heat, clarification, emulsification, storing, maturing, flavoring, impregnation, preservation and the material of the container.[1]"

Speaking of drugs, Charaka has this to say :[2]

"And of that material this is the test : that it is of such and such nature, of such quality, of such efficacy, is born of such a season, gathered in such a manner, preserved in such a way, medicated thus, and in such dosage, administered in such and such a disease to such a person either eliminates or allays such and such a humor. And if there be any other administered medication ins imilar manner, it should also be examined.[3]"

Charaka [4] elaborates on the drug action of simples :

"Long pepper, pungent though in taste, is sweet in post-digestion, heavy, neither overmuch unctious nor overmuch hot, is deliquescent and esteemed as medicine. It is at once productive of beneficial and baneful effects. If administered in the proper time and measure, its action is at once beneficial. But if continued for over a long period, it results in morbid cumulative effect, as due to its heavy and deliquescent qualities it arouses phlegm. It aggravates bile on account of its hot property, and is not able to allay wind because of its meagerness of unctious and hot qualities. Nevertheless it makes a good vehicle. In view of these considerations long pepper should not be used in excess.[5]"

Complex preparations of materia medica are described throughout Charaka's work. A not uncommon type of compound preparation is the following, perhaps a universal remedy, as a myrobalan remedy.[6]

"Make a decoction of the chebulic, emblic and belleric myrobalans together with all the five groups of pentaradices. Add to it the paste

[1] *Charaka*, I, p. 325.
[2] *Charaka, Vimāna*, VIII,. p. 87.
[3] *Ibid.*, I, p. 327.
[4] *Charaka, Virvana-sthāna* I.
[5] *Ibid.*, p. 329.
[6] *Ibid.*, V, pp. 480-1, *Cikitsa-sthāna.*

of long pepper, licorice, *mahwa*, *kākōli*, *ksīra-kākōli*, cowage, *jīvaka*, *ṛṣabhaka* and milky yam. Add to it the infusion of white yam. Cook the whole thing in eight times the quantity of cow's milk and 2048 tolas of ghee. Taking this elixir in the dose determined by one's digestive strength and following it in its digestion by a meal of *sāli* or *sāṣṭika* rice, with ghee and milk and the post-prandial potion of hot water, one becomes exempt from the consequences of old age, disease, sin and black magic and gaining unrivalled strength of body, senses and intelligence, becomes a man of unthwarted enterprises, and attains great longevity. Thus has been described the fifth emblic myrobalan recipe."

An important prescription is the following, an elixir :

"Take a quantity of chebulic, emblic and belleric myrobalans, turmeric, ticktrefoil, heart-leaved sida, embelia, guduch, dry ginger, licorice, long pepper, and gum arabic tree, and cook in a ghee extracted from milk and mix it with honey and sugar. Add to the above the powder of emblic myrobalan which has been impregnated a hundred times with the fresh juice of emblic myrobalans together with one-fourth the quantity of iron powder. Of this elixir take every morning one tola in accord with the rules already laid down. In the evening eat a meal consisting of cooked *sāli* or *sāṣṭika* rice, seasoned with ghee, in conjunction with either the soup of green grain or cow's milk. By taking a course of this *rasāyana* in this manner for a period of three years, one remains young for a hundred years, improves one's memory, and overcomes all diseases. In such a man's body even poison becomes innocuous; his limbs grow hard and compact like stone; he becomes invulnerable to creatures.[1]"

Many medical writings followed the works of Charaka and Susruta in India. Slowly these became known in Persia and in the Arabic world. One such work was a pharmacological text by an Indian called Shānāq. The treatise is restricted to poisons. It was translated into Persian from an Indian language by one called Mankah, at the Abbasid court, then into Arabic from the Persian by abū Ḥātim for Yaḥyā b. Khālid, probably in the early part of the ninth century. It is called *Kitāb al-sumūm wa'l-tiryāqāt* in Arabic, "Book of poisons and theriacs.[2]" The text contains some substances from Greek sources

[1] *Ibid.*, V, pp. 480-1.
[2] *Cf.* C. Brockelmann, *Gesch. d. Arab. Litteratur* (Leiden, 1937) I, S, pp. 413, 428, 431.

and symptomatology and prescriptions from older Indian treatises.[1]

The relationship among the Arabic, Indian and Greek pharmacological texts is depicted in the lives of the men mentioned above.

Of the life of Shānāq not much is known. One of the earliest references to him is in ibn al-Waḥshīya's *Kitāb al-sumūm* (ca. 950). Shānāq's book is mentioned as "great and important." In fact much of the material in this book is to be found in ibn al-Waḥshīya's treatise.[2]

To the author of the Fihrist (987),[3] ibn al-Nadīm, Shānāq was known also as the author of books on the conduct of life, the management of war, and a translator from Sanskrit to Arabic. Mentioned by ibn abī Uṣaibi'a are his works on the stars, a lapidary, and one on veterinary matters.

Mankah was known to ibn al-Nadīm as a physician in the hospital of Jundīshāpūr, a great cultural center of the Nestorians. He is known to have been a translator of medical works into Arabic from Indian. For example, he translated an Indian *Book on Names of Drugs* for Isḥāq b. Sulaimān.[4] Much more important is the fact that Mankah is known as the translator of the *Susruta Saṃhitā*, a huge medical compendium, for Yaḥyā b. Khālid. Ibn abī Uṣaibi'a (1203/4-1270) also discusses Mankah [5] as an Indian physician of importance.[6]

The translator of Shānāq's work from Persian into Arabic, abu Ḥātim of Balkh, is known only as a contemporary of Mankah and as a worker for Yaḥyā b. Khālid. Abū Ḥātim was thus comparable to the Syriac translators who were frequently middlemen between the Greeks and Arabs in Jundīshāpūr and other Nestorian centers. A later example of this type of cooperative translation is that of the Jews in Spain, Italy, and Sicily who served mainly as intermediary translators between the Arabic and Latin versions of philosophical and scientific works.

[1] Another text, which should be mentioned, which is of Indian origin on this subject is that of Zanṭaḥ, called *Kitāb al-sumūmāt*, "Book on Poisons;" the manuscript is now in the Baghdad museum. A copy of this, by courtesy of the Baghdad officials, was used by the present author.

[2] M. Levey, *Medieval Arabic Toxicology, The Book of Poisons of ibn al-Waḥshīya* (Philadelphia, 1966).

[3] G. Fluegel, ed., *Fihrist* (Leipzig, 1871-72) pp. 245-303.

[4] *Ibid.*, pp. 203, 244-45, 303, 316.

[5] Al-Jāḥiẓ (d. 868/9) knew Mankah, *Kitāb al-bayān wa't-tabyīn* (Cairo, 1351 H) I, 90.

[6] Ibn abī Uṣaibi'a, *op. cit.*, vol. II, p. 33.

Another translation of Shānāq was carried out by al-'Abbās ibn Sa'īd al-Jauharī, a contemporary of al-Ma'mūn (Abbasid Caliph 813-833) and a well known early Islamic astronomer and commentator of the *Elements* of Euclid.

Yaḥyā ibn Khālid, the Barmecid, was famous in his day in the field of science. In ibn al-Nadīm,[1] it is related that Yaḥyā sent a scholar to India to study Indian drugs and religion and fetched Indian physicians and philosophers westward so that he might learn from them.

Contemporary with Mankah a the Court of Yaḥyā the Barmecid was another Indian physician, ibn Dhan. The latter, who was director of a hospital, translated such Indian medical treatises into Persian or Arabic [2] as *Ashṭaṅgahrdaya*, *Siddhāyoga*, and probably others.

Ibn al-Waḥshīya, in his book on poisons, gives a detailed bibliography. This unusual list is worth quoting since it serves to point out the various influences on a medical writer of Mesopotamia in the middle of the tenth century A.D. The author is concerned only with books on poisons, particularly those discussed by the Syriac authors Yārbūqā and Sūhāb Sāṭ, since he claims that his work is a translation of the works of these two but that he also used other books on the same subject.

First are quoted the "Books of the Persians and Indians."

1. "Book of Shānāq," also called "The Unique"[3] and "Book of the Orphans."

[1] E.S. Holmyard, *Alchemy* (Baltimore, 1957) pp. 69-70.

[2] Ibn al-Nadīm in *Al-Fihrist*, pp. 245, 303, gives a list of Indian Medical texts rendered into Arabic during the Abbasid Caliphate. Charaka was translated into Persian by Mankah, then into Arabic by 'Abdullah b. 'Alī; Susruta into Arabic by Mankah, Mdāna into Arabic by an unknown writer, *Kitāb al-sumūm* into Persian by Mankah and later into Arabic by 'Abbās ibn Sa'id for Caliph al-Ma'mūn, a "Book on Venoms," a "Short Treatise on Drugs," a book giving names of drugs in ten different languages, a book concerning properties and notions of drugs where the Indians and Greeks differ, and others on medicine in general and on special ailments. Other Indian physicians mentioned by Arabic writers are in the *Fihrist*, pp. 270-271. Some of these have already been noted. An important Indian practitioner, Ṣāliḥ, who lived in Baghdad during the reign of Hārūn al-Rashīd (786-814 A.D.), although well known, did not leave any writings (*Ṭabaqāt al-aṭibbā'*, II, pp. 34-35).

[3] *Cf.* B. Strauss, "Das Giftbuch des Shānāq," *Quellen und Studien d. Naturwiss. in Med. IV*, 89-152 (1935). This text has the following statement, "Shānāq, the wise, says, "The old Indian wise men call this book 'The Unique' since it is the only one of its kind'." This statement mayi mply that it was the only treatise devoted solely to poisons.

2. Anonymous book containing extensive descriptions of properties [of poisons].
3. Book by Tammashah, an Indian, which is very extensive.
4. Book by Bahlīndād, an Indian.
5. A book compiled for some Persian kings, "The Five Signs," which has been translated into Arabic.
6. A book compiled for Nūshirwān the Just.[1]
7. A book on poisons compiled by a Persian; it is owned by the King of Isfahan.
8. "The Rhymed Book on Poisons." It was translated into Arabic and was a famous work; it is probably of Persian origin.
9. Book by Buzurjmihr. [He is supposed to have been a minister of Khusrau I, Nūshirwān. Some believe that he was Burzōē who, in a period of great Indian influence in Persia, made a Pahlavi adaptation of the *Panchatantra*. He was also a character in many old anecdotes.[2]] "I believe that this book antedates Buzurjmihr but was later attributed to him."

Thus, before 850 A.D., the most important Indian medical works had been made known to the Arab world. The medical theories of the Indians, however, were not accepted by the Muslims. In the work of abū Sahl 'Alī ibn Rabban al-Ṭabarī, for example, in his *Firdaus al-ḥikma*, "Paradise of Wisdom." (850), the entire text, except for some drugs, is a continuation of Greek medical theory and practice. Nevertheless, at the end of the text, a special section is devoted to a description of Indian medicine based on Charaka, Susruta, the *Nidāna*, and the *Ashṭāṅgahrdaya*.[3]

In the pharmacology[4] of the *Firdaus al-ḥikma*, the substances ingested, as in Susruta are, according to the text, food and drugs. Food is meant to nourish the human organism while drugs are to

[1] Nūshirwān, or Nūshirwān as his name is sometimes transliterated, reigned over the Persian Empire from 531-578 A.D. *Cf.* E.G. Browne, *A Literary History of Persia* (Cambridge, 1956) vol. I, pp. 166 ff.

[2] *Encyclopedia of Islam*, 2nd ed., vol. I, p. 1359; A. Christensen, *Acta Orientalia III*, 81-128 (1930) on lethal foods and the symptoms arising from poisoned food.

[3] *Cf.* 'Alī Rabban al-Ṭabarī, *Firdaus al-ḥikma*, ed. by M.Z. Siddiqī (Berlin, 1928) pp. 591-594.

[4] *Cf.* M.Z. Siddīqī, *Studies in Arabic and Persian Medical Literature* (Calcutta, 1959) p. 95; *Firdaus al-ḥikma*, pp. 356 ff.

change it in certain directions. A slight throwback to Indian ideas may be discerned in a statement of 'Alī that the tastes of drugs indicate certain of their properties. Bitter drugs clear the chest of thick phlegm, sour drugs purify the ducts, and sweet substances nourish the organs,.

As to the principles which determine the uses of certain medicaments in 'Alī ibn Rabban, the most general one is *contraria contrariis*. Whenever possible, therapy by drugs is only used as a last resort. This is very different from Indian ideas of therapy.

Greek Influence

From the viewpoint of literary influence, it was Greek botany and medicine which had, by far, the most unusual effect upon the Arabs. One of the greatest botanists of all time was Theophrastus of Eresos, Lesbos (b. *ca.* 372- d. *ca.* 288 B.C.). He was a pupil of Plato and Aristotle, succeeding the latter as head of the Lyceum (323 - *ca.* 288). Although the work of Theophrastus[1] was mentioned by ibn al-Waḥshīya, the latter's *Kitāb al-sumūm* bears no internal proof of the former's texts having been used. It was not until the late medieval period when Theophrastus' botanical works were translated from the Greek into Arabic and Latin that he exerted influence of any strength. In this way, Theophrastus was not in the mainstream of botanical and pharmacological ideas in the early centuries of Islam.

For a closer look at the true beginning of Greek pharmacology, it is essential to go back in time to the early Greek medicine of Hippocrates (*ca.* 460-360) of Cos. Unfortunately, only a portion of what is known as the Hippocratic collection survives; some of the corpus is pseudo-Hippocratic, definitely later accretions. These opera, made available in the Arabic in the century following 750 A.D., do not yield a satisfactory picture of the pharmacological knowledge of the time. Even though present knowledge of the materia medica of this school is incomplete, the importance of the Hippocratic system in regard to pharmacology as now known lies in another direction, in its possible application of some of the primitive humoral ideas of

[1] This has been published as *Theophrastus Enquiry into Plants*, edited and transl. by A.F. Hart, Loeb Classical Library (London, 1948).

disease. The postulated Indian origin of this formulation is still uncertain. It is significant that in the Hippocratic works, *De diaeta* and *De ratione victus in acutis* for example, very few drugs are recommended. Simples used are those such as gruel of barley, various wines and honey.

Galen (2nd cent. A.D.), by writing commentaries (Ḥunain listed 16) on many books of the Hippocratic collection, popularized Hippocrates as the greatest physician of ancient times. The school of Ḥunain ibn Isḥāq (9th cent.), one of Islam's greatest translators, gave the Syriac and Arabic versions of Galen's works.[1] Ḥunain himself translated many of the Hippocratic and Galenic writings into Syriac and Arabic. Accompanying these translations were those of Aristotle's works thus permitting him to exert a great influence on the biology, logic, and medicine of the Arabic writers. Aristotle's work had already been put into Syriac by Sergius (d. 536) but it was translated into Arabic by the reputable Ḥunain and his school.

Compared with previous medical writers, Galen demonstrated a much greater faith in the use of many kinds of drugs as well as a more marked attention to the questions involved in his pharmacology. Of all the relevant Greek treatises, Galen's proved to be the most effective stimulant on the medical arts for Near Eastern physicians. The works made up an encyclopedia of the medical teaching of Greek physicians until his time. Among his major pharmacological texts were included large writings on simple and compound remedies as well as on antidotes and theriacs. As a thorough worker, Galen kept a constant eye on the development and modification of the humoral theory. Even though this very influential theory may have been doubted and much emended in the next 1500 years, it exerted a powerful effect upon the entire period of medieval Arabic pharmacology and on other aspects of their medicine. It should be recognized, however, that it was, at the same time, very difficult to contest this highly organized set of ideas because of the lack of a sufficient and necessary development mainly of chemistry, both in theory and practice. As the Arabic period wore on, the constant emendations, additions, and its neglect at times, tended to diminish, little by little,

[1] G. Bergsträsser, *Ḥunain ibn Isḥāq über syrischen und arabischen Gaben Uebersetzungen* (Leipzig, 1925).

its sancrosanct character. This was a slow process of attrition which finally was brought to a decisive stage with the growth of early nineteenth century chemistry and other basic sciences.

It is of interest to note that the chronological descent of early pharmacological knowledge proceeded concurrently with a changing continuum of growth of botanical knowledge. A major portion of Galen's understanding of Greek pharmacology was derived from a prior work by the first century Dioscorides of Anazarbus in Cilicia (before 150 A.D.). The latter, now recognized as the greatest and most original Greek pharmacologist of the ancients, was a military physician who travelled widely throughout the Mediterranean area, studying botany and the prevalent materia medica. This experience, together with the work of the herbalist, Crateuas (*ca.* 150 B.C.), helped him to write one of the most influential pharmacological textbooks ever known.

In his introduction, Pedanius Dioscorides explains why he wrote his work.

"Although many writers of modern times, as well as of antiquity, have composed Treatises on the preparation, power and testing of medicines, I will try to show you that I was not moved to this undertaking by any vain or senseless impulse. It was because some of these authors did not perfect their work, while others derived most of their account from histories. Iolas the Bithynian and Heraclides the Tarentine did indeed slightly touch upon the subject, but they entirely omitted the Treatise on Herbs and failed to record all metallics and spices. Crateuas, the *rhizotomist* (authority on roots), and Andreas, the physician, appear to have been better versed in this part of the subject than the others, but have passed over many very serviceable roots and have given insufficient descriptions of several herbs. Yet it must be confessed that though the matters which they have transmitted are few, yet the ancients have used great diligence in their work.

"We may not be wholly in agreement with the modern writers, among whom are Julius Bassus, Niceratus and Petronius, Niger and Diodotus, all Asclepiads. They have in a manner deigned to describe familiar facts well known to all, but they have transmitted the powers of medicine and their examination cursorily, not estimating their efficacy by experience, but by vain prating about the cause, have lifted up each medicine to a heap of controversy : and besides this

they have recorded one thing by mistake for another. Thus Niger, who seems to be a man of special note amongst them, states that Euphorbion is the juice of Chamelaia growing in Italy, that Androsaimon is the same as Hypericon, and that Aloe is a mineral growing in Judaea, and in the face of plain evidence he sets down many more such falsehoods, which are tokens that he acquired his information not by his own observation, but had it only from the false relation of hearsay. Moreover, they have offended in the classification of medicines: some couple together those of quite contrary faculties, others follow an alphabetical arrangement in their writing, and have separated both the kinds and operations of things that are closely related so that thereby they come to be harder to remember.[1]"

The exactness and intensity of the botanical studies of Dioscorides are described in the introduction to his work in some general remarks.

"Before all else it is proper to use care both in the storing up and in the gathering of herbs each at its due season, for it is according to this that medicines either do their work, or become quite ineffectual. We ought to gather herbs when the weather is clear, for there is a great difference whether it be dry or rainy when the gathering is made. The place also makes a difference : whether the localities be mountainous and high, whether they lie open to the wind, whether they be cold and dry; upon this the stronger forces of drugs depend. Medicinal plants found growing on plains, in plashy and shady localities, where the wind cannot blow through, are for the most part the weaker; and especially those that are not gathered at the right season, or else are decayed through weakness. It must also not be forgotten that herbs frequently ripen earlier or later according to the characteristics of the country and the temperature of the year, and that while some of them by an innate property bear flowers and leaves in winter, others flower twice a year. Now it behooves anyone who desires to be a skillful herbalist, to be present when the plants first shoot out of the earth, when they are fully grown, and when they begin to fade. For he who is only present at the budding of the herbs cannot know it when full grown, nor can he who hath examined a full-grown herb,

[1] John Goodyer, trans. in 1655, *The Greek Herbal of Dioscorides*, R.T. Gunther, ed. (Oxford, 1934) pp. 1-2.

recognized it when it has only just appeared above the ground. Owing to changes in the shape of leaves and the size of stalks, and of the flower and fruits, and of certain other known characteristics, great mistake has been made by some who have not paid proper attention to them in this manner... Therefore the man who will observe his herbs oftentimes and in divers places, will acquire the greatest knowledge of them. We must likewise be aware that only those Medicinal Herbs, the White and Black Hellebore, *Veratrum album* and *Helleborus niger*, retain their power for many years; the others, for the most part, will only keep good for use for three years. But herbs which are full of branches ... should be gathered whilst they are great with seeds; flowers ought to be gathered before they fall; fruits when they are ripe, and seeds when they begin to dry, and before they fall out. To extract the juice of herbs, take their stalks when they are newly sprouted; and so too with the leaves. But for taking juices and tears, the stems should be cut while yet in their ripeness. Roots for storing or for the extraction of juices and the peeling of barks should be collected when the herbs are beginning to lose their leaves, when those which are clean may be set to dry forthwith in dry places, but those which have earth or clay sticking to them must be washed with water. Flowers and sweet-scented things should be laid up in dry boxes of Lime-wood : but there are some gherbs which do well enough if wrapped up in papers or leaves for the preservation of their seeds. For moist medicines some thicker material such as silver, or glass, or horn will agree best. Yes, and earthenware, if it be not thin, is fitting enough, and so is wood, particularly if it be box-wood. Vessels of brass will be suitable for eye medicines and for liquids and for all that are compounded of vinegar or of liquid pitch or of Cedria, but fats and marrows ought to be put up in vessels of tin.[1]"

Dioscorides' work is divided into five books which include animal, plant, and mineral substances. Because of the importance of Dioscorides to Arabic pharmacology, several examples of his descriptions are in order. These have been taken from the Goodyer edition which, it should be remembered, contains some pseudo-Dioscoridean material. In the material selected, however, there is little difference of any import-

[1] *Ibid.*, pp. 3-4.

ance from the edition by Wellmann generally accepted as the most trustworthy :

"Akanthoda or Prickly Plants
Chamaileon Leukos. Atractylis gummifera

Pine Thistle

"White Chamaeleon [but some call it Chrysisceptrum, some Ixia, ye Romans Carduus varius, the Aegyptians Epher, but some Epthosephim] is called Ixia because in some places viscous matter is found at the roots of it which also women use instead of mastick. It hath leaves like Silybum, or Carduus but rougher, sharper and stronger than the black Chamaeleon. It hath not a stalk but out of ye midst puts out a prickle like that of the sea Urchin, or Cinara : ye flowers are of a purple colour like hairs, flying away in downe, but a seed like to Cnicus; but ye root in fruitful hills is gross, but in ye mountains slendered, white at ye bottom, somewhat aromatical of a strong sweet savour. This being drank ye quantity of an Acetabulum expells ye broad worm. But it is taken in hard wine with ye decoction of Origanum, and to ye hydropicall also a dragm is given with wine, for it extenuates them : and ye decoction thereof is drank for ye Dysourie and being drank with wine it is a Theriaca, and being kneaded with Polenta and diluted with water and oil it kills both doggs, and swine, and mice.[1]"

Another description of interest is given in Book V under Metallic Stones.

Aimatites Lithos. Haematite

"That is ye best Haematites lapis which is brittle and of a deep colour, or black, but in itself hard and even, not partaking of any filth, or girdling vains. But it hath a faculty of bending, of somewhat warming and extenuating; of wearing off ye scars and scabrousness that are in ye eyes with honey; and with woman's milk [it is good for] lippitudes and broken and bloodshotten eyes. And it is drank

[1] *Ibid.*, p. 243 from Book III; *Cf.* Max Wellmann, ed., *Pedanii Dioscuridis Anazarbei De Materia Medica* (Greek edition), 3 vols (Berlin, 1906) vol. II, pp. 14-15.

with wine for ye Dysurie and for women's fluxes; and for spitting of blood with Pomegranat juice. And there is made of it Collyries, and touchstones fitting for the passions in the eyes. But it is burnt like to the Phrygian stone, only ye wine outset. But let this be ye measure of ye burning, that it become indifferently light, and swollen up with some bubbles. Some counterfeit ye aforesaid thus. Taking a piece of ye stone Schistus, both thick and round [and such are they which are called the roots of it] they cover it in an earthen big-bellied vessel, having hot ashes [in it] : then leaving it a little while, they take it out, and rub it on a touchstone, trying whether it have taken ye colour of ye Haematites, and if it have so, they set it up; and if not, they cover it again, continually looking to it and proving it, for if left too long in the ashes, it changeth in colour and then dissolves. But that which is adulterated is reproved, first by ye veins running between for this is broken into veins going out straight, but Haematites hath them not so; [secondly] by ye colour, for this sends out a flourishing colour, but ye Haematites a deeper one, like to Cinnabaris. And it is found also in the Sinopicall Rubrica : and Haematites is made of the Loade stone burnt very much, but that which grows of itself, is digged out of the mines in Egypt.[1]"

Not only was the *Materia Medica* of Dioscorides used as a base by many Muslim writers but, because of its flexibility of arrangement for further study and research, in the hands of the Arabs it led to a greater improvement in pharmacology. The Dioscorides treatise overcame the rigidity of the earlier Mesopotamian lexical lists.[2]

Considered on the scale of its value for individual physicians of early Arabic times, the Dioscorides text provided a ready reference to most simples, especially of the Mediterranean area, their synonyms, provenience, description of morphological parts used, appearance, preparation, and pharmacological data. The first hand observations of the author, particularly with regard to botanical morphology, lent clarity to his descriptions and made the work more valuable to the student.

[1] Goodyer, *op. cit.*, p. 652; Wellmann, *op. cit.*, vol. III, pp. 94-95.

[2] M. Meyerhof, "Die materia medica des Dioskurides bei den Arabern," *Quellen und Studien z. Gesch. d. Naturwiss. u. d. Medizin 3*, 72-84 (1933); E.S. Holmyard, "Medieval Arabic Pharmacology," *Proc. of the Royal Society of Medicine, Sect. of History of Medicine 19*, 99-108 (1935). For an account of the herbal in antiquity, *cf.* C. Singer in *Journal of Hellenic Studies 47*, 1-52 (1927).

It was Iṣṭafān ibn Basīl (9th cent.) who first translated Dioscorides' *Materia Medica* into Arabic; it was done without an intermediate Syriac translation. Iṣṭafān, a resident of Baghdad, was a pupil of the famed Ḥunain ibn Isḥāq who later retranslated and improved much of the work.[1]

Before going further, it is necessary to relate some of what the Greeks did in pharmacology after Dioscorides. Aëtius Amidenus (502-575) and Oribasius (4th cent.) may be passed over quickly since they were merely borrowers. On the other hand, Alexander of Tralles (525-605) who though not original, managed to exert influence since his work was early translated into Arabic.[2] An important physician, Yaḥyā ibn Sarābiyūn or Sarāfiyūn (2nd half of 9th cent.) used his work.[3]

The last of the Greek compilers was Paulus of Aegina (7th cent.). Since he was a scholar and a good synthesizer, his works are of interest, especially his *Epitomae medicae libri septem.*[4] Al-Rāzī (9th cent.) made frequent use of this treatise as did Albucasis, also called Abulcasis from the original abū al-Qāsim (d. *ca.* 1013); the latter copied from the section on surgery (6th book).

Part of the *Epitome* is a section devoted to the use of drugs giving descriptions brief and to the point. As has been pointed out elsewhere,[5] these accounts are similar to those found in the prior works of al-Zahrāwī, Dioscorides and Galen, and that of ibn al-Waḥshīya. It would be relevant to give a few sections of Paulus' work since it occurs in the first century of Islam.

"Dry collyrium. Galen's prophylactic. Finely pulverized Phrygian stone is placed in an earthenware pot, burned until it glows, and then cooled by butter which is not old. It is burned again in the same

[1] L. Leclerc, "De la traduction arabe de Dioscorides et des traductions arabes en général," *Journal Asiatique 9*, 5-38 (1867); H.-P.-J. Renaud, "La contribution des Arabes à la connaissance des espèces végétals : les botanistes Musulmans," *Bulletin de la Soc. des Sciences Natural du Maroc 15*, 60 (1935).

[2] T. Puschmann, ed. and transl., *Alexander im Tralles* (Amsterdam, 1963) reprint of Vienna, 1878 edition.

[3] *Cf.* J. Freind, *The History of Physick* (London, 1750) vol. II, pp. 42-43.

[4] J.L. Heiberg, ed., *Paulus Aegina* (Lipsiae, 1912).

[5] S. Hamarneh and G. Sonnedecker, *A Pharmaceutical View of Abulcasis al-Zahrāwī in Moorish Spain* (London, 1963) pp. 24, 26; M. Levey, *Medieval Arabic Toxicology.*

manner and cooled in Falernian wine. It is then burned a third time and then cooled in honey, then dried. Of this, 1 pound is taken, as well as 1 ounce each of pepper, copper ore, malabathrum, and ½ ounce of antimony. Pulverize it all finely and add thick balsam juice before putting it away — it prevents drying up of the drugs — and also one ounce of the finest mica. It is employed only for the eyelids, and indeed so that when one applies it, it will not remain on the skin, but only on the opened lids. It is necessary to repeat this salving process before and after mealtimes, especially when one notices the presence of a sensitivity. It is remarkable how much more effectively prophylactic it is than the other medium.[1]"

Another prescription reads :

"The plaster with sour dough to open the abscess. Six ounces each of sour dough and fat, four ounces of salt, three ounces of pine resin, four ounces of wax, one ounce of natron foam, two ounces of ammoniacal smoke, six ounces of honey, and two ounces of soap."

Paulus of Aegina is not mentioned by ibn al-Waḥshīya [2] when he lists Greek authors, mainly on poisons, to whom he is indebted,

"There are also those books which are from the Greeks. One of them contains two treatises on poisons of Dioscorides appended to a book on hashish. There is a pleasant book of Theophrastus. I hold it in esteem, my dear son, for what it contains in it on the subject of remedies. Then there is a treatise on poisons attributed to Galen. Also, there is a book on poisons attributed to a man called Alexander. I do not know if he is Alexander the Physician or the other one who is a philosopher. I know two Alexanders aside from Alexander, the king, and the Alexander who compiled a book on the art. The latter is an Egyptian, and is a philosopher and scholar."

In the work of Paulus of Aegina, the prescriptions are very brief; the quantities and the dosage are not always given.

The treatise may be considered to be a compilation mainly from Galen's works and not very important to later writers since Galen was readily available.

[1] L. Berendes, transl., *Paulus' von Aegina Sieben Bücher* (Leiden, 1914) pp. 788-89.

[2] In his *Kitāb al-sumūm*, MS Velieddin 2542, fol. 141b.

Pharmacology in Ancient Egypt

How deep the impact was of ancient Egyptian medicine upon the Arab physicians is not too difficult to determine. In actuality, it was slight. Linguistic studies, for example, on the materia medica of al-Kindī's *Aqrābādhīn* [1] indicate that very few names of botanicals and materia medica in general were taken from the hieroglyphic, demotic, and hieratic Egyptian.

The major evidence for the history of ancient Egyptian pharmacology comes from the following works, named after their discoverer or owner, the Papyrus Ebers (written *ca.* 1600 B.C.), Berlin Papyrus (written *ca.* 1350), and the Leiden Papyrus (*ca.* first millennium B.C.). There are others of a more specialized nature relating to the regimen for health, gynaecology, and on veterinary medicine, mostly fragmented.

In the Papyrus Ebers, there is a section on prescriptions written in hieratic Egyptian script which is well preserved. The pharmacology in this work may have originated a few hundred years earlier.

Some prescriptions read :

"Another salve *[nwd.t]* to make bones healthy everywhere in the human body. It is very effective.

"Natron 1; *wšb.t* — mineral 1; fat 1; black flint 1; honey 1; are all mixed into one and bound on.[2]"

"For a wound on the breast, *wšb.t* mineral 1; lower Egypt salt 1; fat 1; are applied to the breast and bound on.[3]"

Burns in General

"Beginning of use of materia medica for a burn. On the first day : black slime *[ʿmʿ.t]* is given. On the second day : a turd of small cattle is cooked, then pulverized finely in *srm.t ḫpr.t* [perhaps some form

[1] M. Levey, *The Medical Formulary or Aqrābādhīn of al-Kindī* (Madison, 1965), *cf. materia medica list.*

[2] Text in W. Wreszinski, *Der Papyrus Ebers*, I Teil, Umschrift (Leipzig, 1913) 80, 2-4; transl. in H. von Deines, H. Grapow, W. Westendorf, *Uebersetzung der Medizinischen Texte* (Berlin, 1958) p. 202 of Vol. IV, 1 of *Grundriss der Medizin der Alten Aegypter* by H. Grapow.

[3] Von Deines et al., *op. cit.*, p. 203; W. Wreszinski, *op. cit.*, 71, 1-3. For Wreszinski see note 75.

of yeast], and administered. On the third day : dried resin *[ʿ3gj.t]* of acacia thorn is pulverized in dough *[šʿ.t]* of barley. Colocynth is cooked, then all is put in fat. It is bound thereon. On the fourth day : wax and fat *[ʿḏ]* of the bullock are cooked with papyrus [unwritten upon] and with legumes, then made into a semisolid consistency and bandaged upon [the wound]. On the fifth day : colocynth *[ḏ3r.t]* 1; red ochre 1; *ḫs* part of *im3-* broadleaf tree 1; are pulverized well with a copper hammer, made into a certain consistency and applied.[1]"

The Berlin Papyrus, badly written in hieratic, contains a section on prescriptions somewhat similar to that in the Ebers document.

Cure for a cough

"Fresh cream of a cow and honey, and manna are eaten four days.[2]

"Cure to counteract many agents of pain in his abdomen. One must prepare a drug to cure the cause of pain and also something to neutralize this matter in the intestines : fat, fresh meat 5 *ro; innk* plant 1/8; parsley 1/16; terebinth resin 1/64; fresh bread 1/64; *sḫp.t* liquid 20 *ro;* Christ's thorn bread 1/8. It is all pulverized finely, cooked, made into a *šʿj.t* cake, then eaten with manna, and sweet beer is drunk for four days.[3]"

Written in the later demotic script, the Leiden Papyrus has much interesting information on the ancient Egyptian drugs.

There is a fragment concerning the *ʿḫw* sickness of the arm.

"Get rid of the difficulty in your arm ... and do not allow the poison *[nšf]* to remain in it. Take *ʿntjw* resin, fat of an ibex, *nj3j3* plant, goat blood, liquid of *mst3*, and make a pulverized mass. Then bind it on the arm. It is good.[4]"

[1] Von Deines et al., *op. cit.*, p. 214: W. Wreszinski, *op. cit.*, 67, 17-22.

[2] Von Deines et al., *op. cit.*, p. 164; W. Wreszinski, *Der grosse medizinische Papyrus des Berliner Museums (Pap. Berl. 3038) in Facsimile und Umschrift mit Uebersetzung, Kommentar und Glossar* (Leipzig, 1909) pp. 3, 5.

[3] Von Deines et al., *op. cit.*, p. 106; W. Wreszinski, *op. cit.*, 12. 12-13, 3.

[4] Von Deines et al., *op. cit.*, pp. 83-84; from Leiden Papyrus verso IX12-X2. *Cf.* A. Massart, *The Leiden Magical Papyrus* I 343 T I 345 *-Oudheidkundige Mededelingen uit het Rijksmuseum van Oudheden te Leiden. Supplement op. nieuwe reeks* xxxiv (Leiden, 1954). For further important writings, see J.H. Breasted, *The Edwin Smith Surgical Papyrus* (Chicago, 1930) 2 vols.; B. Ebbell, *The Papyrus Ebers, the Greatest Egyptian*

Transmission of Pharmacology to Arabic Writers

Some allusion has already been made to translations into Arabic from Sanskrit, Persian and Greek. Largely because of a favorable chain of circumstances before Muḥammad and shortly after, the Muslims, in a short period, came into possession of much of the world's greatest scientific and philosophical literature in their lingua franca, Arabic. In this period, the oral transmission of scientific and technological literature was not inconsiderable. This has been demonstrated indirectly by a linguistic study of the origins of botanical names of materia medica found in a work of al-Kindī (ninth cent.).[1] Further, pre-Islamic Arabic poetry indicates that the Bedouins possessed a fair knowledge of substances from the animal, vegetable, and mineral kingdoms of their native region.

A large current of earlier science flowed to the Arabs through the Nestorians, a Christian sect founded in 428 A.D. by the patriarch of Constantinople, Nestorius. Condemned as heretics by the Council of Ephesus in 431, the group was forced to leave for Edessa, following which it was expelled by the Byzantine Zeno in 489, forcing settlement in Nisibis under Persian rule. From there, in the early part of the sixth century, the Nestorians moved to Jundīshāpūr, in southwest Persia. The reason, in part, for this last move was that this city possessed a large hospital and an academy which had been founded in the fourth century by the Sassanian king. Many Greek scholars came here from Athens after Justinian closed the philosophical schools in 529 so that they came in contact with Syrian, Persian, and Indian intellectuals. The Persian, King Chosroes Nūshīrwān, in this century, contributed much to making Jundīshāpūr the world's greatest center of scholarship of the time.

Chosroes encouraged translation from the Sanskrit into Pahlavi (Middle Persian), and from Greek into Persian and the last two into Syriac. Syriac was much favored since it was a common language of

Medical Document (Copenhagen, 1937); A.H. Gardiner, *The Ramesseum Papyri* (Oxford, 1955); F. Jonkheere, *Le Papyrus Médical Chester Beatty* (Bruxelles, 1947); G.A. Reisner, *The Hearst Medical Papyrus, Hieratic Text with Introduction and Vocabulary* (Leipzig, 1905); W.C. Till, *Die Arzneikunde der Kopten* (Berlin, 1951); W. Wreszinski, *Der Londoner Medizinische Papyrus und der Papyrus Hearst...* (Leipzig, 1912).

[1] M. Levey, *The Medical Formulary... of al-Kindī* (Madison, 1956) pp. 20 ff.

intellectuals in that part of Persia. The academy and hospital were unharmed by the conquering Arabs so that Jundīshāpūr remained as a cultural capital for the new Islam. It became the source of radiation of scientific and other studies to the remainder of the growing Islamic world. During the Umayyad period (661-749), at the beginning of the eighth century, the first scientific book in Arabic was brought into existence by the Persian Jew, Māsarjawaih, who translated Ahron's *Pandects*. Many of the physicians of Jundīshāpūr, mostly Christians and Jews, came to practice in Damascus and, slightly later, in Baghdad, the Muslim capitals, and in other great Arabic and Persian cities. During the Umayyad period, much of alchemy and astrology was seated in the eastern and northern provinces of Persia since it was these which more than others came under the influence of the Chinese and Indians.[1]

The pace of translation accelerated suddenly in the Abbasid era (750 - *ca.* 900). Syriac and Arabic abruptly became the new languages of science, giving way to Arabic alone by the end of the ninth century. The peak of activity was during and shortly after the reign of Caliph Ma'mūn who set up in Baghdad a school specially for translation, and also founded a library in 856. Ḥunain ibn Isḥāq (890-877) was its most famous director. As a physician with a strong linguistic background, he translated the entire Galennic corpus into 100 Syriac and 39 Arabic treatises of both the medical and philosophical books. Ḥunain also translated such Greek books as Oribasius' *Synopsis*, *Seven Books* of Paulus of Aegina, Dioscorides' *Materia Medica*, and many other important works. In addition, he wrote books of his own on medicine. Ḥunain translated part of Hippocrates; his disciples, about ninety, did most of the remainder. His son Isḥāq, his nephew Ḥubaīsh (2nd half of 9th cent.),[2] Qusṭā ibn Lūqā (d. *ca.* 912) of Ḥarrān, and Thābit ibn Qurra (9th cent.) were also outstanding translators as well as physicians.[3]

Contemporary with Ḥunain was al-Kindī (d. *ca.* 873) who wrote

[1] M. Meyerhof, "Von Alexandrien nach Baghdad," *Sitzungsber. der Preussischen Akademie der Wissenschaften, Phil.-hist. Klasse 23*, 389-429 (1930).

[2] *Idem*, "New Light on Ḥunain," *Isis 8*, 708 (1926).

[3] A fair account of the medical history of this period may be found in D. Campbell's *Arabian Medicine* (London, 1926), and a more dispassionate one in E.G. Browne's *Arabian Medicine* (Cambridge, 1921).

a medical formulary and other works in this area as well as better known treatises on philosophy and in various diverse fields. Since al-Kindī lived in a gathering of Indian, Chinese, Persian, Egyptian, and Greek thought in Baghdad, his formulary has been analyzed as to its sources.[1] Trade at this time between the Arabs and the rest of the world, both by sea and overland, was brisk in many commodities. In this way, plants, drugs, stones, and other materials useful in medicine, came to the attention of the Arabs. Jābir (*ca.* 8th cent.) was one of the earliest to write on pharmacology, particularly on toxicology. No doubt, his extensive chemical knowledge was of assistance to him as shown in his *Kitāb al-sumūm.*[2]

In speaking of books on poisons by Arabs, ibn al-Waḥshīya mentioned Jābir in his *Kitāb al-sumūm.*

"The genuine Arabs ... also compiled books in the Islamic Age on poisons. One of them Jābir ibn Ḥayyān al-Ṣūfī, is said to be from Azd. If this is true, then he was a genuine Arab. This book of his on poisons is a great work containing numerous and extensive accounts as well as many practical applications. It is a wonder. A book which was compiled by Yaḥyā b. al-Biṭrīq al-Rūmī on poisons in the time of al-Rashīd is also a great and useful book. Ibn al-Biṭrīq also translated two anonymous treatises on poisons and articles of ancient scholars. The author of *Memorandum Book of the Physician* declares that discussion of poisons in very early Islam and in pre-Islamic times was rare. A man called 'Īsā b. Sāsa compiled a book on poisons as has been done nowdays by others such as Qusṭā b. Lūqā and Ya'qūb ibn Isḥāq al-Kindī.[3]

The heritage of science which came to the Muslims was treated with the utmost respect and care. They treasured it, passed it on quickly to their colleagues in Africa, Spain, India and other regions. In was later transmitted to the West in Europe with the same intensity and fervor with which they received it. Participating in this process were people of many nations and of many religious persuasions; it was the first supranational science on a grand scale.

[1] M. Levey, *The Medical Formulary... of al-Kindī.*

[2] A. Siggel, *Das Buch der Gifte des Ǧābir ibn Ḥayyān* (Wiesbaden, 1958); M. Meyerhof, chapter in *Legacy of Islam* (Oxford, 1931) pp. 311-355.

[3] *Cf.* M. Levey, *Chymia, 9,* 36-37 (1963).

CHAPTER TWO

THEORETICAL CONSIDERATIONS IN ARABIC PHARMACOLOGY

Humoral Theory

In spite of the fact that the early Greek medical schools had their differences, their basic approach, because of their parallel origins, was similar.[1] Their thesis on pathology remained in the foreground of medical thinking for thousands of years including the period of Arabic activity in medicine.

This hardly means that pharmacological theory in the Arabic era remained static. On the contrary, marked qualitative and quantitative changes took place. From the early works of the ninth century to the thirteenth, a marked divergence in pharmacological ideas accompanied a rapid growth of new concepts in chemistry and medicine.

Pharmacology was entirely dominated by Galenic theory in the ninth century. No original thinking is evident, for example, in the work of Isḥāq ibn 'Alī al-Ruhāwī, a physician and philosopher of this period. Thus :

"The organs of the organized body by which the functions are carried on are sound in three ways. One is by the harmony of the complexion of the organ. The second is by the harmony of the four elements in the body. These are equal to each other. There is as much heat as cold and as much moisture as dryness. This is a harmony whose existence is not necessarily obvious to the senses but is true in theory. This is because the body at any instant cannot remain in one state but it changes continuously from one state to another.

"The second class of harmony is akin to the first and close to it in importance but rarely found.

"The third class is very common and inclines toward one of the four complexions, *i.e.* heat with dryness, heat with moisture, cold with moisture, or cold with dryness. They are to be found in the

[1] O. Temkin, "Der systematische Zusammenhang im Corpus Hippocraticum," *Kyklos, 1,* 9-43 (1928).

healthy and are not, in themselves, faulty. For this reason, they are called harmonious. It is necessary to preserve health in the case of each of these complexions. This is impossible until one has acquired knowledge of their qualities and quantities as well as their symptoms. In this way, one may retain the qualities, quantities, locations, times, and other elements of preservation as the ancient physicians explained in their books.[1]"

Also, in the same vein, is the description of Job of Edessa (9th cent.) of the "functional cause of the four humors : red bile, black bile, blood and phlegm, and of their coming into existence from the elements..." The translation is by A. Mingana from the Syriac manuscript.

"The functional cause for which the four humours which are in the body came into existence, is that they should act as intermediaries between nutrition and the bodies. In one way, they resemble nutrition, and in another way the bodies, so that through this mutual resemblance, they may receive nutrition, and thus impart increase to the bodies, and so that in this way these bodies may possess growth, increase and existence [itself]...

"...In the first coming together (of the elements) the light and hot parts mixed with the heavy and cold parts, through the medium of dryness and humidity, a seething took place, on account of the antipathy of heat and cold mixing through humidity and dryness, similar to that produced by fire under a cauldron of brass, which, through its dryness, receives the heat of the fire, and through its heat expands the humidity which is found in the water, and thus gives rise to boiling, and to the change in the cooking of the food; and, through the boiling, the hard and heavy parts (in the food) dissolve and join with the humid part, through the hot parts, and in this way the change that takes place in the two antipathetic parts remains in the humidity, which itself dissolves the dryness (found in the food), in the same boiling, through the power of the heat, and from them one chyle [2] is produced. This same process worked with the elements [in connection with the humours].

"...In the same way as its humours were composed of the elements

[1] *Adab al-ṭabīb*, in a unique copy in Edirne, MS Selemiye Kutubhane 1658, fols. 16a-16b; *cf.* also M, Levey, *Arabic Medical Deontology* (Philadelphia, 1967).

[2] *I.e.* one of the biles, blood, or phlegm.

through the changes of cooking and boiling, by the action of heat mixing with humidity, so also the bodies of animals were composed of them, by the warming action of heat. When there was heat, the parts that were thin and light departed from them, and thick parts were formed, and by their mutual composition a body that was harder and more earthy than they were came into being...

"When the humours underwent a change from their humid state, so that they might become bodies, the heavier and drier part found in them contracted to itself separately, and was solidified, and became bones; and the colder and drier parts which they contained was solidified, and became nerves, veins, arteries, and tendons; and the hot and humid part that was in them gave birth to flesh; and the part of them that was fatter gave birth to fat and adipose tissue. In this way the constitution of the body was composed through the general combination of like things with like things.[1]"

From this brief extract, it is not difficult to ascertain the pharmacological principles which would be essential to conform with these ideas so well formulated by Galen over 500 years previously. With the passage of time, however, the powerful hold of the early Greek medical structure began to loosen. New data were put into evidence, more drugs became known, and, from time to time, a questioner arose to reveal a broader view in pharmacological science. One of these was Najīb al-Dīn al-Samarqandī who had visited Baghdad but lived in Herāt, Persia (now a part of Afganistan). He died in 1222 A.D. when the entire city was put to the sword by Mongols.

Of his medical works, one of the most interesting in regard to pharmacology is his *Aqrābādhīn*,[2] "Medical Formulary." This treatise is also called *Kitāb al-qarābādhīn ʿalā tartīb al-ʿilal*, "Treatise on the Medical Formulary on Compounding for Diseases.[3]" After a lengthy introduction, the book includes nineteen chapters which discuss the

[1] Job of Edessa, *Book of Treasures*, transl. A. Mingana, (Cambridge, 1935) pp.25-28. This work was written about 817 in Baghdad where it was employed as an encyclopedia of the philosophical and natural sciences for teaching purposes.

[2] This is a loan word from the Greek meaning "list" or "registry", *γραφείδιον*. The manuscripts used were mainly Aya Sofya 3555 and Leiden 1353. The copy in the Patna library and the Bodleian MS were checked.

[3] M. Levey and N. Al-Khaledy, *The Medical Formulary of al-Samarqandī and the Relation of Early Arabic Simples to Those Found in the Indigenous Medicine of the Near East and India* (Philadelphia, 1965).

preparation of syrups, robs, stomachic confections, aperients, lohochs,[1] and other forms of medical preparations. The preparations will be discussed in another chapter; it is the introduction, in which al-Samarqandī essays a rationalization of his pharmacology and therapy, which is of interest at this point.

As will be shown from the author's own words, his text displays a hesitant and compromising reliance on the humoral pathology of the Greeks and also on Indian pharmacological ideas and practice. In all fairness to al-Samarqandī, it would have been impossible in his period to have rejected the ingrained Galenic theories in the rigid framework of thirteenth century Muslim society. More important, chemistry and medicine had not yet come to the point of a sufficient and necessary accumulation of hard facts to aid in the development of a new or different theoretical basis for pharmacology. Partly offsetting these difficulties was the fact that al-Samarqandī was a resident of a city on the periphery of both the Muslim and Indian cultures. This must have permitted him some freedom not allowed in Baghdad.[2] Without voicing open objection to all the contemporary pharmacological ideas of his day, al-Samarqandī, nevertheless, frequently neglected use of the compounding of drugs and the quantities used under certain conditions.

In the absence of the simple which would be effective al-Samarqandī gives the reasons for compounding. The references to a humor in the following passage are not too significant when so many more statements made do not concern the idea.

The circumstances leading to the use of compound remedies involve various conditions. "It is partly because of the aspect of the nature of sickness or disease, partly because of the state of the organs, and partly because of the drug. For the use of compounded drugs there are fourteen reasons. One of them is due to the extent of the ill humor if there is no drug opposite to it in strength. It is then compounded

[1] *Rubb* (Ar.) is thickened juice of ripe fruit which has been evaporated to a syrupy consistency. *La'ūq* (Ar.) is something licked usually to exert a local action in the throat.

[2] Witness the controversy between ibn Buṭlān and ibn Riḍwān each attempting to rival the other in conformity, J. Schacht and M. Meyerhof, "Une controverse médico-philosophique au Caire en 441 de hégire (1050 ap. J.-C.)..." *Bull. de l'Inst. d'Egypte 19*, 29-43 (1937); also ibn Buṭlān's works; *cf.* ibn Ithirdī's answers to questions posed by ibn Buṭlān in *Bull. Hist. Med.* by M. Levey, *39*, 495-507 (1965).

from one which is stronger in the quantity of its [humor] with one which is less so. From these a blend is put together to resist that ill humor. The second is concerned with the strength and acuteness of the illness when there is no single drug which can resist it. It is then compounded so that the constituents may assist one another in resistance. Third, there are the differences in the state of the disease and attendant circumstances, and its treatment; a drug is unknown which [by itself] performs opposite actions like absorbing [1] and bringing up [2] in chest ailments, and the freeing [3] and hindering of tumors, so that one must be compounded. Fourth is a basic one, a means to counteract many poisons and different ailments. This is noblest of compounded ones because it protects one from constriction with a strength superior to the strength of any simple. Its effectiveness is due to the strength of its simples. The fifth has to do with the remoteness of the ailing organ from the stomach. It is compounded with a drug which is useful for it and [with one which] makes it reach [the organ] quickly as saffron with camphor,[4] and Chinese cinnamon with haematite.[5] The sixth concerns the strength and importance of the organ and its size and functions. A drug is mixed to dissolve tumors and to ease [at the same time] the properties which lessen [a drug's] effectiveness to act as a restraining remedy. The seventh relates to the unsavoriness of the drug and its disagreeableness until it is improved to the point of acceptability by nature. The eighth has to do with the increase of potency of a drug as in mixing ginger with turpeth.[6] The ninth protects some organs against the harmfulness of a drug as by correctives with purgatives, and the tenth is the inadequacy of a drug

[1] *Jalā'*, also clearing.

[2] *Tamlīs*, smoothing.

[3] *Taḥlīl*, dissolving of tumors.

[4] For heart ailments, since camphor penetrates the heart. *Cf.* M. Levey, *Medieval Arabic Bookmaking* (Philadelphia, 1962) p. 17.

[5] A desiccative and astringent. *Cf.* J.L. Soubeiran, *La Matière Médicale chez les Chinois* (Paris, 1874) pp. 154-155; M. Levey *al-Kindī*, pp. 335-36.

[6] The Sanskrit is *trivṛit* meaning "three sided" from the appearance of the plant. It is also found in the ninth century work on medicine translated by A.C. Achundow, "Die pharmakologischen Grundsätze der abu Mansur Muwaffak ibn Ali Harawi," *Hist. Stud. a.d. Pharmak. Inst... Dorpat*, III, 170, 174 (1893). It is still used today in Egypt in electuaries and as a purgative—M.A.H. Ducros, "Essai Sur Le Droguier Populaire Arabe... Du Caire," *Mémoires prés. à l'Institut d'Égypte 15*, 28-29 (1930).

like gum arabic in the collyrium of verdigris.[1] The eleventh concerns the destruction of the evil [property] of a drug as mixing castoreum [2] with opium. The twelfth is for keeping the strength of the compounded drug for a long time as in mixing opium with the major electuaries. The thirteenth is concerned with the differences of drugs in their amounts and usages in the desired direction as in mixing a *qīrūṭi* [3] unguent with the essentials in poultices. The fourteenth is the need of a single useful remedy for an illness as in mixing the unguent with verdigris to from an effective drug for wounds when there are no other drugs good for wounds available.[4]"

In the fourteen reasons given for the compounding of drugs, there is a greater emphasis upon an empirical form of therapy rather than a heavy concentration on the humors; the latter is an aspect of the earlier literature of al-Rāzī, ibn Sīnā, and many others. This will be seen in later chapters where the sources will be translated and discussed.

In the drug quantities used by al-Samarqandī in making up the remedies, the humoral idea is still present but well circumscribed by other determining factors.

"As to the reasons for the differences in weight, there are seven simple ones as well as combinatory reasons of these simple ones. As to the seven simple ones, the first is the strength and weakness in its [the drug's] natures. Second is the value or lack of its usefulness. Third is the importance or non-existence of its benefits. Fourth is its partnership in usefulness or its being alone. The fifth is concerned with the location of the ailing organ in regard to its proximity to or distance from the stomach. Sixth is the existence or non-existence of drugs in the compounded one which weakens its strength. Seventh is the existence of harmfulness in it for some organs, or for inadequacy of the drugs or their oversufficiency.[5]"

Further, al-Samarqandī agrees with a basic idea also manifested

[1] It is still used in the Near East today for eye ailments. *Cf.* M. Levey, *Medieval Arabic Bookmaking*, p. 21.

[2] Cairo bazaars sell this today as a resolvent, antispasmodic, stimulant, and antihysteric.

[3] A gloss reads, "A kind of wax and oil mixture." It generally means "cerate" or "salve used medicinally."

[4] Al-Samarqandī's *Aqrābādhīn*, MS Aya Sofya 3555, fols. 4b-5a.

[5] *Ibid*,. fols. 5a-5b.

throughout the Hippocratic corpus, that man often finds his way to health through the intervention of natural reaction in the body.

"The physician should not treat everything of a minor character or small change occurring in the body with a drug. Rather, he should treat it by changing the method of management and by adjusting the necessary basic conditions. He must not stir up anything nor impair the body in its natural functions. It is more difficult to quiet the stirring than to stir the quiet. Whenever we can, we should treat by nutritive drugs, and, if compelled, by pure drugs not going beyond the simples as much as possible.[1]"

In a sense, therefore, the pharmacotherapeutic ideas of al-Samarqandī are somewhat related to those in the Hippocratic corpus. Galen and Arabic writers agreed with the *vis medicatrix naturalis*. Further, al-Samarqandī not only considered the humors but espoused the importance of taking account of the "accidents" of drugs in a broader theorization of their basic pragmatic value. This was deeply involved with the essence of chemical theory.

It was al-Samarqandī who, in describing the reluctance of some physicians to allow for growth and development of knowledge, quoted the great poet al-Mutanabbī : "Their works remain after the masters but time catches up to lose the former also.[2]"

Thus, the effort to find an improved and more practicable pharmacological theory in the Arabic period brought about a complex and tortuous groping for facts and ideas similar in many ways to that which took place in the contemporaneous development of chemistry. Since chemical and pharmacological ideas influenced the growth of each other, it is appropriate to discuss, at least briefly, the chemical theory at this time.

As with Aristotle,[3] Job of Edessa declares that the simple elements are heat, cold, dryness, and moistness.[4] In turn, the compound ones are earth, water which is above it, the air which is above the water, and fire above the air. Bodies are then composed of the compound elements, according to Job. Additions to these elements are perhaps types of change as contraction, composition, decrease, dissolution,

[1] *Ibid.*, fols. 3b-4a.

[2] *Ibid.*, fol. 15a.

[3] *De generatione et corruptione*, book II, chap. 1-7.

[4] A. Mingana, *Job of Edessa's Book of Treasures* pp. 5 ff.

and expansion to make up the kinds of accidents. These give rise to the properties of a (chemical) body. In the case of the human body, an immoderate change in the elements gives rise to illness. The change which has taken place must therefore be reserved.

Elements come together to form the general and species of the material world susceptible to the senses. All this, of course, is by the will of the Creator. It is the elements and their changes which determine life and death, sickness and good health, and other factors to please the Maker.

Job of Edessa's explanation of the particulate theory of matter and its application to questions of health and illness is Greek. With the ancients as with Job, the compound elements acted through the intermediary of the humors formed from them.

Chemical Theory

Throughout the entire period, from the early ninth century to Job of Edessa to the thirteenth century, the Arabic world continued intensive interest in the elements and atomic theory. Job's text does not give evidence of a knowledge of Democritus, Leucippus, and similar work. However, it was not long afterward when an intensive public controversy broke out among the Muslims. A movement was afoot, as a branch of philosophy, to answer objectors to the Koran and Islam in general. It, in effect, arose as an effort to solve basic problems of creation and religion. Known as the *kalām*, literally "conversation," a translation of the Greek *dialektiké*, it was intended to be a rational explanation of religion and included a thoroughgoing elaboration of the structure of matter and its relation to the Creator.[1] Indirectly, it gave a particulate theory for medicine.

The ideas of the *mutakallimūn*, the expositors of the *kalām*, came largely from Greek knowledge of the sciences and the relevant philosophy including that of the early great atomists.[2] The *mutakallimūn* assumed the task of explaining the notions of motion, space and time, and how they are concerned with matter, its construction, and its

[1] S.M. Afnan, *Avicenna, His Life and Works* (London, 1958) p. 17.

[2] N. Lasswitz, *Geschichte der Atomistik* (Hamburg, 1890) vol. I, p. 135; F. Delitzsch, *Anecdota zur Geschichte der mittelalterlichen Scholastik unter Juden und Moselmen* (Leipzig, 1841) p. 294, note 2.

various characteristics. All this elaboration was necessary to clarify the ultimate concepts of the creation and the working of Allah.

According to some, the standard author on *kalām* who provided material for all the later writers was Abu'l-Hudhail al-'Allāf of Basra (226 A.H.).[1] His work, part of which is still extant in fragments and quotations, dealt with justice, monotheism, the promise, the threat, and the intermediate state. The first refers to freedom of the will and the punishment of unbelievers.

An excellent twelfth-century account of the ideas of the *mutakallimūn* on atomic theory is given in Maimonides.[2] The principles of the atomic theory expounded by the *mutakallimūn* as given by Maimonides are in twelve sections.[3] Briefly, they are :

1. Every corporeal substance is made up of very small parts called atoms. These atoms are alike; they have no quantitative properties or relationships but may, at different times, possess qualitative values. When atoms come together, they are unified, combined, or compounded, or they are separated by some type of dissolution. In other words, there are four "being" states- being unified or brought together, being separated, being in motion, and being at rest. God is continually re-creating this infinite number of atoms.

2. Between atoms, there is a vacuum type of separation. This vacuum allows for combination and separation. Atoms may come in contact with one another but cannot interpenetrate.

3. Time consists of atomic time elements or intervals not infinitely divisible, just as space and motion eventually come to the end of their divisibility. The paradoxes of Zeno are thus avoided by eliminating infinitesimals.[4]

[1] *Cf.* Yaqūt, *Dictionary of Learned Men* (London, 1913), vol. 6, p. 74; F. Sezgin, *Geschichte des Arabischen Schrifttums* (Leiden, 1967) I, p. 618.

[2] *More Nebuchim*, written in the early part of the twelfth century. It was translated from the Arabic into Hebrew at an early date. The best edition is that of S. Munk, *Guide des égarés* (Paris, 1856-1856) in Arabic and French. *Cf.* also H. Ritter, *Über unsere Kenntnis d. arab. Philosophie u. besonders über die Philosophie d. orthodoxen arab. Dogmatiker* (Göttingen, 1844); on time and re-creation, *vide* D.B. Macdonald, *Isis 9*, 326 ff. (1926).

[3] S. Munk, *op. cit.*, Vol. I, p. 375 ff; M. Friedländer, *The Guide for the Perplexed* (London, 1951) 2nd ed. *Cf.* also the scientific ideas of the Brethren of Purity in Adel Awa, *L'Esprit Critique des "Frères de la Pureté"* (Beyrouth, 1948) pp. 58-109.

[4] *Vide* M. Horten, *Die Philosophischen Probleme der Spekulativen Theologie im Islam* (Bonn, 1910).

4. To the atom may be appended certain properties, "accidents," such as rest, motion, life, death, ignorance, knowledge, combination, separation, etc. If it has, for example, one accident, then it has other modifying ones also appended and usually accompanying it. For example, life carries along with it such accidents as strong or weak, big or small, and so on. Since only Allah has lasting attributes, those accidents belonging to atoms are only temporary appendages.

5. Atoms themselves must have the attached accidents. If something appears to be of a certain color, then that color is believed to be in every single atom. A body and not an atom possesses quantity. Every atom in a living body possesses life and so powers of reasoning, ignorance or knowledge, etc.; the nature of the spirit, however, is an uncertain one. What kind of accident this is proved to be a difficulty for Arabian theologian and scientists.

6. Matter is inseparable from accidents which, themselves, cannot endure two atoms of time. Thus, Allah continually re-creates the accidents. This idea agrees with the observations that everything is in motion or at rest, or changes constantly in some fashion. Some scholars, however, contended that some atoms and accidents were created for a length of time and so did not necessitate continual recreation. There is no nature in things except by the will of Allah — only an accident by His consent or will.

7. Not only are positive accidents created by Allah, but the negative ones require His will as well; for example, these are ignorance, rest, and death. All of these are real, positive entities.

8. There are only material atoms and their accompanying accidents. These atoms, being all alike, form their differences by their different accidents and nothing else. Form is not considered to be of any significance, thus avoiding Aristotelian-Neoplatonism which considered matter and form to be of equal importance.

9. Only atoms have accidents. The possession of one accident by an atom does not prejudice its action with or possession of others. Also, one accident may not exist in another accident.

10. An atom cannot become an accident, or vice versa. An atom cannot exist without an accident, or an accident cannot exist without an atom or in it. Things which exist possess no necessity themselves but do so only by the will of Allah. Therefore. existing things might have been made differently by Allah to retain order in the system of nature.

11. There is no infinity of space, time, or extension, since the universe was created at the beginning and so had a Beginner.

12. The senses err and so cannot prove a case against a rational demonstration. Thus, motion is in leaps but appears continuous. Matter appears continuous but is in discrete particles. Recreation is at every moment but appears as one continuous impression. The senses create illusions, since time must be in atoms according to pure reason.[1]

Moses ben Maimun (1135-1205) himself opposed the atomic theory. If there are atoms, according to Maimonides, then they are discrete, cannot come together or act upon each other, and cannot be held in the bonds of a unit space or follow the edict of cause and effect. Thus, there is no motion, velocity, continuity, or coherence, but each atom is completely separate and self-contained. There would then be no permanence; the world would have to be continually renewed by Allah, and time would have to be a succession of atomic time moments.[2]

Although Maimonides gave a good general account of the atomic theory of the *kalām*, details of a richer nature may be found in earlier Arabic manscripts.[3] To a large extent, the description of Maimonides was that of the contemporary believers in the atomic theory.

In an older account, that of al-Ash'arī, various terms were coined for the atom, usually indicating the original or primordial indivisible substance, such as *al-juz' alladhī lā yatajazza'*, *al-juz' al-wāḥid*, *al-*

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[1] D.B. Macdonald, *Isis*, *9*, 329-337 (1927).

[2] L. Roth, *The Guide for the Perplexed* (London, 1948) pp. 54-55.

[3] H.S. Nyberg, *Kitāb al-intiṣār*, by Abu'l-Ḥusain 'Abd al-Raḥim b. Muḥammad al-Ḫayyāt (Cairo, 1926); H. Ritter, *Maqālat al-islāmiyyīn*, by Abu'l-Ḥasan 'Alī b. Ismā'il al-Ash'arī (Istanbul, 1930). *Cf.* also O. Pretzl, *Islam 19*, 117-130 (1931), for a discussion of the contribution of Ash'arī, and also that of the famous philosopher A. Bakr b. 'Alī b. al-Ṭaiyib al-Baṣrī al-Bāqillanī (d. 1013), who was a pupil of Ash'arī and wrote the *Kitāb al-tamhīd wa'l-radd 'ala al-mulḥida wa'l-mu'aṭṭila wa'l-rāfida wa'l-mu'tazila*, MS Paris Ar. 6090. Al-Bāqillānī, one of the best known of the older Ash'arites, was famous for his polemical writings in which he introduced Greek philosophy or perhaps the dogmatics of the Eastern Church into the *kalām*. He dealt with such subjects as concepts of atoms, empty space, accidents as bearers of other accidents, and other problems of ancient atomic theory. Another work of his is *Kitāb fī i'jaz al-Qū'rān* (Cairo, 1897). *Cf.* also H. Steiner, *Actes du VIII congrès internat. des orient... 1889 à Stockholm et à Christiana*, sect. 1 (Leiden, 1891) p. 108; also H. Steiner, *Die Mu'taziliten oder die Freidenker im Islam* (Leipzig, 1865); M. Horten, *Die Phil. Systeme der Spek. Theologen im Islam* (Bonn, 1912) pp. 539-542.

jawhar al-wāḥid, al-jawhar al-wāḥid alladhī lā yanqasim, or, in short, *juz'* or *jawhar*.[1]

The relation of the atom to matter in regard to the corporeality of Allah and His creation was taken up seriously by the early *mutakallimūn*.[2] The depth of their ideas may be detected in the wide range of their thinking as shown here briefly in some quotes.

Abū Rashīd (932-1068), as a member of the Basran school of thought, assumed that the atom had dimensions and, therefore, that two atoms as a minimum would constitute a body.[3] He discussed the problem of the possibility of one atom taking the place of two atoms.[4] He also stated that two atoms may be separated without the presence of a third one between them. Empty space is thus postulated.[5] This is in contradiction to the opinion of abū al-Qāsim. However, abū Rashīd declared that the atom must have a dimension.[6] Other Muslims believed that the minimum number of atoms in a body was four, six, or eight.[7]

On the combining *(ta'līf, i'tilāf, tarkīb, ijtimā'*, all having various shades of meaning as combination, rearrangement, completion, etc.) of atoms various opinions were expressed by Muslim writers. Most of them contended that it was not the atom itself but the body composed of atoms which created the attribute of dimension. This is one

[1] Abū al-Ḥasan 'Alī ibn Ismā'il al-Ash'arī was born in Basra in 873/4 and died in 935/6. He was originally a Mu'tazilite but was reconverted to Sunnite orthodoxy in 913 and thenceforth devoted himself to the development of a scientific rationale in the defense of his faith. He composed a large number of works, over 100, of a dogmatic and polemic nature. Ash'arī was the founder of orthodox scholasticism *(kalām)* as a well-ordered, concerted attack on his opponents by means of a dialectical approach. Ash'arī overcame the antipathy of older Muslim scholars to dialectic in articles of faith by his successful utilization of its various heresies. In this way, Ash'arī supplied an intellectual need of orthodoxy in his time. *Cf.* B. Mac Guckin de Slane, *Ibn Khallikan's Biographical Dictionary* (Paris, 1843-1871): T.J. de Boer, *The History of Philosophy in Islam* (London, 1933) pp. 56 ff.; C. Brockelmann, *op. cit.*, (Weimar, Leiden, 1893) vol. I, p. 195. *Vide* also Pretzl, *op. cit.*, and S. Pines, *Beiträge z. islamischen Atomlehre* (Grūfhainichen, 1936) p. 3.

[2] H.A. Wolfson, *Journal of the American Oriental Society* 79, 73-80 (1959). *Cf.* also F. Dieterici, *Der Musterstaat von Alfarabi* (Leiden, 1900) pp. 34 ff.

[3] A. Biram, *Kitābu'l-masā'il fi'l-khilāf bain al-Baṣriyyīn wa'l-Baghdadiyyīn al-kalām fi'l-jawāhir abū Rashīd Sa'īd b. Muḥammad b. Sa'īd al-Nisābūrī* (Berlin, 1902)

[4] Biram, *op. cit.*, p. 36.

[5] *Ibid.*, pp. 36-43.

[6] *Ibid.*, p. 47.

[7] Ibn al-Murtaḍā's *Al-baḥr al-zakhkhār* fol. 27a-b, in M. Horton, *op. cit.*, p. 221.

of the fundamental differences between the theory of Democritus and that of the *kalām* since Democritus believed that matter and the atom possessed basic properties which produced its attributes. Abū'l-Qāsim al-Balkhī [1] believed that the property of extension of a body did not come about as a result of a characteristic of an atom but arose from a property of the new category, the combination *(ta'līf)*. Thus, he understood length.[2]

Involved in the problem of the combination of atoms is another concerned with the possibility of their touching one another *(mumāssa)*. Much has been written on this subject.

Hishām al-Fuwaṭī [3] claimed that a body consists of thirty-six indivisible parts or atoms, since every body is made of six *arkān* (existing things) each of which is also divided into six atoms.

Al-Rāzī contended that there were five types of atoms *(jawhar)*, in his *Kitāb sirr al-asrār*, as God, soul, time, matter, and space. These atoms were indivisible and separated by a vacuum.[4] Density determined the characteristics of softness, hardness, lightness, etc., of the four major elements — earth, air, water, and fire. The spaces between the atoms determined the motion of the elements, whether they would rise as air and fire, or descend as water and earth.[5]

Abū al-Hudhail, the early philosopher already mentioned, taught that a body was that which possessed a right and a left, front and rear, and top and bottom. A body must, therefore, consist of at least six parts or atoms.[6]

Some Arabs thought, as did abū Bishr al-Sāliḥī,[7] that only two atoms could come together. Some believed that two atoms formed a plane and three a solid. If one were to concede, according to al-Sāliḥī, that one atom could touch a larger surface, then the entire world could be placed in a very small volume.

Although Averroes was, to a large extent, a follower of Aristotle, he nevertheless had many ideas of his own in regard to atomic theory.

[1] F. Sezgin, *op. cit.*, I, pp. 622-3.

[2] *Kitāb al-faiṣal fī al-milal wa'l-ahwā' wa'l-niḥal* by Ibn Ḥazm (Miṣr, 1321 A.H.); M. Horten, *Die phil. Probleme...*, pp. 94-79, 220 ff.

[3] H. Ritter, *op. cit.*, p. 304.

[4] J. Ruska, Al-Rāzī's *Buch Geheimniss der Geheimnisse* (Berlin, 1937).

[5] G. Heym, *Ambix I*, 188 (1938).

[6] H. Ritter, *op. cit.*, p. 302.

[7] *Loc. cit.*

Averroes sought to distinguish between substrate and matter. This an Aristotelian cannot do. He said, "There are two relationships in Aristotle on the matter-form idea : 1. a relation substrate and property, and simultaneously, 2. a successive relation between cause and effect.[1]"

Averroes then goes on to state, "When two materials are mixed, a third material arises, *i.e.* a new form. The old forms were potentially the new form ... The body exists, on the whole, of bodies and actual atoms. Why? Because it is a substrate ... Aristotle considered matter as a *principium individuationis;* two pictures of Hermes of the same pose are individually distinguishable since they are made of distinguishable materials.[2]

Let us examine in greater detail the ideas of the atomic theory pro and con, particularly in abū Rashīd and in Avicenna.

Abū Rashīd [3] was the author of a treatise on the study of atomic substances in the book of controversial points between the scholars of Basra and Baghdad.[4] He was a pupil of Qāḍī 'Abd al-Jabbār (*ca.* 936-1025 in Raiy), the author of *Al-muḥīṭ bit-taklīf*,[5] and belonged to the school of Basra.[6]

In this book, abū Rashīd attempted to explain simultaneous existence and nonexistence, division of atoms, their origin, the coexistence of two bodies in the same place and time. Briefly, the Basran system was a combination of atomistic and Aristotelian viewpoints, corpuscular physics integrated with a theory of substantial forms. Substance is defined as that which, in its existence, fills a space and is probably not further divisible. This substance is the atom; they are thus both the same. By "atom" is meant that which is not divisible. There is

[1] H. Ley, *Studien zur Geschichte des Materialmus im Mittelalter* (Berlin, 1957) pp. 414 ff.; DeLacy O'Leary, *Arabic Thought and its Place in History* (London, 1922) p. 255; S. Van den Bergh, *Die Epitome der Metaphysik des Averroes* (Leiden, 1924) pp. 10, 160, 172.

[2] Van den Bergh, *op. cit.*, p. 173.

[3] W. Alhwardt, *Verzeichniss der arabischen Handschriften der Kng. Bibliothek zu Berlin*, vol. IV, p. 448. His full name is Abū Rashīd Sa'īd b. M. b. Sa'īd al-Nisāburī.

[4] *Kitāb al-masā'il fi'l-khilāf bain al-Baṣrīyīn wa'l-Baghdādīyīn. Al-kalām fi'l-jawāhir*, MS Berlin 5225. *Cf.* A. Biram, *op. cit.*, for text and translation. For an old but still fairly good account of the schools of Basra and Baghdad and their controversies, *cf.* H. Steiner, *Die Mu'taziliten* (Leipzig, 1865) pp. 80-94.

[5] Brockelmann. *op. cit.*, G.I, p. 419, S. I, p. 343; F. Sezgin, *op. cit.*, I, 624-5.

[6] *Cf.* C. Brockelmann, *op. cit.*, I, pp. 343-344.

also the "isolated atom." When the atoms take up three-dimensional space, then there is body; an atom takes up only two-dimensional space. The attribute of the filling of space signifies that atoms have accidents, that one prohibits others from occupying its space, with the further properties of being seen and felt. The atom also has a definite orientation in order to prevent another from taking its place and also orienting the second atom nto ione of the six positions allowable with respect to the first one.

The attribute of existence, *wujūd*, is a result of the taking up of space. In fact, even in nonexistence, the atom does have an attribute, that of substantiality. The directional attribute depends on one of the accidents of the substance, that is, the "being" of the atom. The orientation persists as long as the same being remains; also, the atoms of the same orientation cannot possess different beings. Thus, the accident is necessary for the orientation, and the orientation is an attribute of substance.

As to the form of the atom, abū Rashīd believed that it is in the form of a parallelopiped or cube so that other atoms may attach themselves very easily to the first. The sphere was therefore ruled out. Mass, a variable with regard to size in Democritus, is a constant like size, for it is a "single property" as is existence. Furthermore, all atoms are alike.

Atoms may not interpenetrate. For motion and certain processes such as condensation and rarefaction or dilution, it is necessary to have the idea of empty space. There is then no continuity of matter. The qualitative nature of atomic properties is determined by the accidents. The latter change particularly in duration, which may not be equated with that of the substance itself. The substance is thus the substrate of the accidents, and the latter persist until taken up elsewhere.

In nonexistence, only the outer existence is lacking, In reality, atoms and accidents are also present in nonexistence. In this way, the difficulty of Aristotle is circumvented, for the *mutakallimūn* did not face the problem of being transformed into nonbeing, and vice versa. Allah simply lends the attribute of existence to atoms and accidents; in other words, Allah creates substances and accidents, but not bodies.

When two atoms, both having the accident of being, come together,

it is combination, or the building of the body. This may also take place in reverse to obtain atoms from a body.

Quoted below are some pertinent excerpts from the text and an explanation by Biram.

"The isolated atom is one near which there is no other. This attribute is a negative one and so does not arise from cause and effect, as abū al-Qāsim contends. There is a cause only when one considers the isolation together with a special orientation which the atom takes on.[1]"

"Being is the special existence of every substance and gives it the attribute of a determined orientation. This is since the substance as soon as it exists and takes up space also must possess an orientation; it is then that the substance which possesses the "being" is not dissociated from it. Ḥasanī gave the basic rule, "Substance may be free from accidents outside of the 'being'.[2]"

"Our teacher abū Hāshim believed that substance may be free from color, taste, odor, and similar accidents, aside from being. When being exists and another being is near it, then they are not free from coming together ... When moisture exists in a substance, then it is not free from a lower pressure while the existence of dryness keeps it in... Further, our teacher abū al-Qāsim also says that the free existence of substance from a dye, taste, odor, warmth, cold, moistness, and dryness is possible.[3]

"Abū 'Alī also agreed when he said that when the substrate meets an accident which has a counterpart, then it cannot free itself of its counterpart and the accident. If it has no counterpart, then it cannot remain free of the accident.

"The reasoning goes as follows. For example, in the case of dye, substance is something other than it. A close combination of both demands their coexistence. This is something which may not be reasoned out. Only Allah knows. This same type of coexistence is to be found in the motion of muscle, and in the bones and hair of the hand, in that they all cooperate. The muscle, which is in motion, while the bones are not, separates them, as we speak of a separation of the top and nether millstones. This is when we say of its diameter

[1] A. Biram, *op. cit.*, p. 42 (Arabic).
[2] *Ibid.*, p. 51 (German).
[3] *Ibid.*, p. 43 (Arabic).

and axis that while some parts are resting, others are moving and therefore a separation ensues..."

Ibn Sīnā, or Avicenna in the Latinized form, an opponent of the atomic theory, was born in Bukhara in 980. This was then a center of Islamic studies. His parents were probably Iranians. Avicenna received extensive tutoring in philosophy and did much reading in the sources then known. By ibn Sīnā's time, a number of translations into the Arabic from the Greek were available. He also studied science, medicine, law and disputation, and finally was in the service of various sultans as a physician. Avicenna loved women, wine, music, and hard work. Eventually, dissipation contributed to his death in 1037. More than 200 books are attributed to Avicenna.[1]

In the tenth and eleventh centuries, the Aristotelian generation, or the coming into being, and corruption, the passing away, was of great interest to philosophers. Earlier there were the monists and pluralists. The former believed that generation and corruption were processes of the same substances. The latter contended that generation was the combination and corruption the dissociation of elementary bodies making up a whole. The Greek atomists developed this idea into a complete theory of matter.

Aristotle, in his *Physica*, claimed, however, that the atomic ideas led to impossible consequences. Avicenna followed Aristotle in spite of the fact that, in his time, almost all Muslim theologians had adopted some form of the atomic theory in regard to generation and corruption.

Avicenna, in refutation of the atomic theory, argued that if a discrete particle is in contact with another, then there may not be an empty space between them. If a third part contacts the first, then there must be some empty space between them. Thus, this aggregate as a whole is divisible; every discrete particle which is associated may then be dissociated or separated. In order to be indivisible, on the other hand, a particle must be completely integrated with another to form out of two. Thus, the particle does not become a component part of a larger composite. So, particles cannot form a complex body.

Reasoning in another direction, when two indivisible particles are placed on two others with one in between, each set may move because of the lack of internal or external opposition. However, if they met

[1] C. Brockelmann, *op. cit.*, I, pp. 452-458, I; pp. 812-814.

an obstruction at one extremity, the other extremity would continue moving. If the obstruction were met at the middle particle, then it would separate and the extremities go apart. This shows they are divisible.[1] Avicenna exerted a great influence on thinking in medieval Europe, especially on Albertus Magnus and Thomas Aquinas.[2]

Arabic atomic theory is to be found applied throughout much of the alchemical literature. In fact, it is to the credit of the Muslim laboratory workers that they were well cognizant of the theory behind their experiments and that they did try to integrate theory with practice. There is frequent description of the accidents of dryness, moistness, color, warmth, cold, and others, as well as their addition or removal by chemical reaction. Thus, the concentration of the chemist was fixed on the separate attributes of substances and their changes in reaction. Although a small number of attributes was considered basic, the Muslims did not allow this to hinder them in allowing for others, and sometimes their gradations.

In an Arabic work obviously taken from al-Rāzī, "arsenic" is described as "... a soul and a mineral. Its nature is warm and moist and comes in two types, yellow and red. That which I have investigated is the pure red than which there is none more effective or stronger in the burning of all metals.[3]" As to iron "... its nature is hot and dry. Some say it is cold and dry. It is male and female,[4] sour in taste, strong in might, resistant to fire...[5]" In this description, it is evident that the alchemists do not agree on the basic properties of iron. This was not recognized as an important conflict until later on, when, with the breakdown of the entire theory, transmutation began to be questioned. From the theory it is obvious, of course, that if it were true, then transmutation was actually possible.[6] For example, alchemists

[1] M. Achena and H. Massé, *Avicenna's Le Livre de Science* (Paris, 1955) pp. 90-91; *Kitāb al-ishārāt wat-tanbīhāt*, on logic (Leiden, 1449-1451); H. Ritter, *Islam 24*, 276 (1937); Ibn Sīnā's *Kitāb al-shifā'* (Cairo, 1956-60); S.M. Afnan, *op. cit.*, pp. 209-211; M. de Wulf, *History of Medieval Philosophy* (Toronto, 1952) vol. I, p. 297.

[2] A.M. Goichon, *La Philosophie d'Avicenne* (Paris, 1951) pp. 90-133; E. Bloch, *Avicenna und die Aristotelische Linke* (Berlin, 1952) pp. 30 ff.; S. Munk, *Mélanges de Philosophie juive et arabe* (Paris, 1859); Carra de Vaux, *Avicenne* (Paris, 1900).

[3] J. Ruska, *Das Buch der Alaune und Salze* (Berlin, 1935) p. 39.

[4] A description going back to Babylonian chemistry.

[5] *Ibid.*, p. 43.

[6] MS Dresden Arabic 413, fol 83a.

believed that silver was convertible to gold since "... the inner part of gold is equal to the outer part of silver, and the outer part of gold is the same as the inner of silver. Its nature (*i.e.* silver) is cold and moist; some say it is cold and dry. It mixes with gold and copper and takes on color..." It is evident that if it is possible to add accidents to silver, then it is possible to remove them from gold to be given to silver.[1] In this way what may now be considered as preposterous had its basis in theory, a theory some of whose parts were taken up by later atomists and applied on another level. Metals, by the way, had their spirit, soul, or body. This is discussed throughout the alchemical literature, mainly in regard to their removal or addition to other substances.[2]

In the period of the golden age of the Muslims (*ca.* 950-1150), philosophy was a subject which encompassed many fields. Many Arabic chemists whose works have come down to us were also concerned with theoretical matters such as the atomic theory, pro and con. It was in this way that early medieval writers in Latin inherited not only a storehouse of chemical facts and much data from experimental results, but also a wealth of theoretical ideas. Some of those who were influenced by Arabic atomic theory were Occam, Nicolaus of Autricuria (14th cent.), Nicolaus of Cusa (15th cent.), Agrippa of Nettesheim (16th cent.), and others who preceded the exposition of the atomic theory as we now know it.[3]

Not only were the Muslims transmitters of early Greek atomic theory but they also contributed many original ideas on the nature of the atom, its association with other atoms, and matter in relation to the atom, and numerous elaborated theories on what occurs in the mixing and solution process. Most important, the Muslims kept alive a thriving interest and concern with theoretical aspects of chemistry, in itself an important contribution to later European chemists.

Chemical theory, as described above, in many ramifications, was well known to the Arabic medical practitioners. At the same time, nevertheless, the humoral theory, in some ways contradictory to the atomic theory, continued in existence. This theory, roughly in one

[1] *Cf.* MS München Arabic 652, fol 89b.

[2] MS München Arabic 652, fol. 89a.

[3] *Cf.* J.R. Partington, *Annals of Science 4*, 245 (1939); R. Hooykaas, *Chymia 2*, 65-80 (1949).

version,[1] states that phlegm, blood, bile, and water are formed from various combinations of the compound elements : heat, cold, dryness, and moistness. Disease is caused by a surplus or deficiency of one or more of the humors. In another Hippocratic treatise, probably by Polybus, *The Nature of Man*, black bile is one of the four cardinal humors. Throughout much of the Arabic period, the most accepted system was that which included the humors of yellow bile, black bile, blood, and phlegm, respectively related to fire and summer, earth and autumn, water and winter, and air and spring. This system had been elaborated by the Greeks so that not only the humors, seasons, and metals had qualities but the organs, diseases, and remedies also possessed them.[2] Chemical theory was thus extended so that it pervaded medical theory.

To make changes in the humors and in their degrees, differences in quality and quantity of drugs in compounded remedies had to be taken into account. Some specific differences were due to the state of the illness, as acuteness, weakness, sharpness, and chronicity, variations in temperature of the body, the state of viscosity, its gentleness, the physical condition of the patient, the beginning, decline, end, and "accidents" which happen to the patient during the period of illness.

Throughout the Arabic period, the best physicians were occupied with preventive medicine. They were kept on a yearly retainer fee, saw their patients almost daily, and associated with them on a social level. The physician's duties concerned all aspects of a patient's life, physical as well as mental. The latter was known to affect one psychosomatically. When a person began to become ill, therefore, the tendency was to tip the balance the other way gently by means of nutritive drugs. When these did not have the desired effect, then simple drugs were employed. As a last resort, al-Samarqandī used compounded drugs. Much emphasis is placed by the author on experience in pharmacology. The method of analogy especially was considered safe and dependable in medical practice.

The medieval Arabs knew over thirty categories of compound remedies. Some of these were easily prepared but many of them took much time and a large number of ingredients in long drawn out

[1] Hippocrates' *On Diseases* IV.

[2] H.E. Sigerist, *A History of Medicine* (New York, 1961) vol. II, pp. 323-4. Polybus was the son-in-law of Hippocrates.

operations. The difficult and complex processes were often carried out by specialists who were actually chemists or apothecaries as we would know them today.

Extensive use and knowledge of chemistry and pharmacology in the practice of Arabic medieval medicine accelerated the development of botany, the cultivation of plants, and other relevant areas of study. In a way, the more elaborate pharmacological practice became, the further and faster other sciences were forced to move to keep up with this phenomenon. Thus, it was not too different from the demands placed on other areas of knowledge by the growing chemical technology of the time.

CHAPTER THREE

BOTANONYMY

Philological Evidence and Arabic Materia Medica

Early Arabic pharmacology is still known among many millions of people in Africa, Asia, and Europe, whether in home remedies or as a part of a systematized branch of a widely accepted kind of medical practice. Even if it were only for this fact, its study would be well worth carrying forward. In order to achieve a better understanding of the reason for this acceptance of Arabic medicine and to give it in turn a historical background with a wider perspective, it is not sufficient to discuss only such figures as Dioscorides, Theophrastus, and the writings of other men and cultures on medicine, chemistry, botany, and pharmacology, all of whose works came just before that of the Arabs.

The inheritance by the Arabs of these scientific treatises, by themselves, is insufficient to provide an adequate explanation of the vast superiority of Arabic pharmacology over its well known antecedents with which it was in contact. This latter fact is true not only in regard to the quantity and quality of drugs but also in improved application, the much wider geographic origin of drugs, their descriptions in a more highly diversified literature especially developed for pharmacology, and in more elaborate botanical identification.

A similar explanation of this unusual growth might also be adduced to the expanded contemporaneous development of botany, zoology, mineralogy, and other related disciplines. But this is also not enough. One of the avenues not too well explored in this so-called "dark period" is that of the paths of transmission of science and learning to the Arabs and their relative contributions from the different as well as very early cultures. There is a novel method which may be used in this study. It is based on the most scientific branch of language, philology, and particularly the etymology of the medicinal names of botanicals. This may be called botanonymy. The latter study, based by analogy on the scientific principles of toponymy and anthroponymy,[1] for example, leads to a variety of unexpected results in new directions.

The basis of botanonymic study should, perhaps, be described. With the passage of a long period of time, technical terms frequently change in meaning. On the other hand, names of certain botanicals frequently differ within the culture or when taken over by another culture. Most of the time, when the botanical is new to another culture, the same name is used. A good example of this is the evergreen oak, probably *Quercus infectoria* L.[2] In ancient Mesopotamia, the oak was ubiquitous and was known for its galls, a highly valued product in chemical technology. The oak was called *beluṭ* and *beliṭ* in Akkadian.[3] The Aramic *ballūṭā* is cognate to the Arabic *ballūṭ*, and to the Akkadian *beluṭ*. The Spanish is *bellota*. From the philological evidence, there is ground for belief in a high correlation between the names of this oak and, on the other hand, its provenience and, perhaps, its later cultivation in different localities. The synonyms above are examples of loanwords.

Markedly different names of botanicals are known from different possible lines of transmission, an occurrence which is very frequent. In the case of the kidney bean, for example, there can be no doubt but that its name did not come from Indian terminology but from that of ancient Mesopotamia. The medieval Arabic term for kidney bean is *lubiyā*. It is *lubbu* in Akkadian and *LU.ÚB* in Sumerian, and *lobia* (pl.) in Greek. In Sanskrit and Hindustani, however, it is *simbi* and *sim* respectively, thus indicating a definite line of demarcation between the ancient Sanskrit and the Sumerian and Akkadian terms.

An interesting example as a combination of translation and borrowing of a technical term when taken into another language is that for the common polypody, in Arabic *basbāyij*. The original Greek is *polupódion*, "having many feet." In Persian, it is *bas-pāyak* and in Syriac *sekā reglē*, both having the same meaning. The Arabic is a loanword from the Persian translation slightly changed to conform with the phonetic rules, in this case from a Persian *k* to an Arabic *j*,

[1] L. Cortes, Garcia Blanco, A. Tovar, eds. *Actes et Mémoires, Cinquième International de Toponomie et d'Anthroponymie 1955; Filisofia y letras* (1958) tomo 9, num. 1.

[2] *Cf.* I. Loew, *Die Flora der Juden*, vol. I, p. 226.

[3] R.C. Thompson, *Dictionary of Assyrian Botany* p. 249.

and from a Persian *p* to an Arabic *b*. Each of the languages has, of course, its own phonetic demands in the acceptance of a term from one of the languages into the other. The changes are not always the same in reverse and so, at times, the original language of the term may be recognized. Most of the time, this is done more easily by using a chronology of the dates of usage of the ancient and medieval languages and dialects.

In the assimilation of technical terms by another language, metathesis may often take place. The phonetic patterns of both the first and the receiving languages would play a major role in this change. For example, the Greek *aspálathos*, a thorn, may have given rise to the Arabic *aslafadas*.[1]

On occasion, not only phonetic rules must be used but also the pharmacological use of the botanicals should be taken into account as an aid in the identification of terms. Chebulic [2] myrobalan, *halīlaj* in Arabic, is found used as a purgative in ancient Indian civilization and often later on. The Greeks did not know it; in Sanskrit it is *harītakī*, in Tokharian *arirāk*, and Chinese *ho-li-lo*, the last two coming from the Sanskrit—the reason being based partly on philological grounds and partly on the fact that the tree is native to India. The Persian *halīla* is from the Sanskrit (in Hindustani, *harrā* or *haryā)*. In Persia today, the chebulic myrobalan, *halīlah-i-Kābulī*, is still used as a strong purgative.[3] In modern Egypt, the drug bazaars also sell it as a purgative botanical.[4]

In the acceptance of a term into another language or in evolution of a name in the same language, many different phonetic changes may occur in a term. Most of these are predictable on a scientific basis. One more example of terminological change will be given here. There is the Arabic term *ḥabaq*, "basil,[5]" which comes about as a result of the loss of an alliterative syllable. It is *ḥubuqbuq* in Aramaic, *ḥabakkuk* in Hebrew, and *ḫambaququ* in Akkadian. It was also called

[1] *Cf.* M. Levey *al-Kindī*, fol. 108a (Arabic); M. Wellmann, *Dioscuridis*, I, p. 20.
[2] *Kābūlī.*
[3] D. Hooper, *Introduction to Materia Medica for India* (London, 1901) p. 177.
[4] A.H. Ducros, *op. cit.*, p. 14.
[5] M. Levey *al-Kindī*, fol. 115b (Arabic), where it is used in an original prescription for fever, for jaundice, and for pain of the stomach and liver.

ḫamuk in Akkadian, from which the Syriac *ḫaūkā* comes.[1] It is still used as a stomachic in Egypt today.[2]

These are only a few of the etymological details necessary in the understanding of the Arabic technical terms. their origins. and their paths of transmission. In this connection, information coming from other fields may be very helpful such as the number of species of a plant in different geographic localities of the Near East and Far East, the course of the spreading of a plant from region to region, commercial trade routes of the early historic and larer eras in Asia, Africa, and Europe, and related medical and technological uses.

Of special importance to Arabic pharmacology are the details of the growth of pre-Arabic chemical technology in such areas as dyeing, tanning, perfumery, glassmaking, and many others. There is inadequate literary evidence on the transfer of the ancient Mesopotamian chemical technology. The Muslim debt in chemistry to the Sumerians and Akkadians is to be seen in the Alexandrian and the slightly later Arabic knowledge of chemistry in the apparatus used, in the processes and operations, and in the chemicals employed.[3] Since a continuing literature in this field over a span of many hundreds of years is lacking, chemical knowledge must have been transmitted orally by the artisans and craftsmen who carried on the learning of technology in their apprenticeship system. One piece of evidence, not quite sufficient as yet, is in the large number of Akkadian botanical names used by the Muslims. A few of these include the Arabic *shibit* or *shibbat*, "dill," cognate to the Akkadian *šibittu*, *ghār*, "sweet bay," related to Akkadian *eru*, *ḫummas*, "chick pea," to Akkadian *ḫūmušu*, and *athl*, "tamarisk gall," to Akkadian *ašlu*. This oral literature, whose importance is not as yet realized because of a general neglect by historians of the science of philology, was of great importance in botany as well, especially in identification of species, the morphological structures which contain their active principles, and their uses in medicine and cooking.

As much as possible, in this study, relevant manuscripts containing material on linguistic aspects, have been used; these include treatises

[1] R.C. Thompson, *op. cit.*, pp. 78 ff.; B. Meissner, *Zeit. f. Assyriologie* (1891) p. 206; Budge, *op. cit.*, fol. 115a; L. Leclerc, transl., *Ibn al-Baiṭār's Kitāb al-jāmi' li-mufradāt al-adwiya wa'l-aghdhiya* (Paris, 1877-1878) nos. 584, 590, 594.
[2] Ducros, *op. cit.*, p. 233.
[3] M. Levey, *Chymia 6*, 20-26 (1920).

on botany, travel, cooking, agriculture, lapidaries, zoology, lexicography and various medieval encyclopedias. It should be remembered that the Muslims had such a strong interest in language that it pervaded most of their works. As a result, the Arabic manuscript literature is rich in multilingual and synonymatic material.

In cases where the etymological evidence may be inconclusive or insufficient to yield the data necessary, other aids may be utilized. In addition to those already mentioned, further checks are the indigenizing of botanicals in ancient and modern times, and statistical information on the number of species mentioned in various works; there is also a variety of information to be gleaned from the archeological remains of plants and their ancient representations, fossils, ancient and present day agriculture in the Near East and elsewhere, modern uses in the Middle East, and the nomenclature presently in use in India, Persia, Iraq, Egypt, and North Africa, both in the professions and in the bazaars.

The philological interests of the early Arabic writers have been mentioned briefly. In passing, some of these should be mentioned as examples. There is al-Bīrūnī's remarkable *Kitāb al-ṣaidala fī al-ṭibb*, "Book on the Pharmacopoeia of Medicine," giving drug synonyms in Syriac, Persian, Greek, Baluchi, Afghan, Kurdi, Indian dialects, and other languages.[1] Maimonides' book on drugs has synonyms in Syriac, in Sanskrit tongues, Persian, Arabic, Hebrew, Berber, and Old Spanish[2]. An important Maghrib text gives drug names in many languages including Berber. It is the *Tuḥfat al-aḥbāb fī māhīat al-nabāt wa'l-a'shāb*, "A Precious Gift to Friends Concerning the Attributes of Plants and Simples." This treatise includes 462 alphabetically arranged entries.[3]

Some unpublished or untranslated texts of great value should be mentioned:

1. 'Izzaddīn a. Isḥāq Ibrāhīm b.M.b. Ṭarkhān b. al-Suwaidī al-Anṣārī (d. 1292) wrote *Al-simāt fī asmā' al-nabāt*, "Special Consideration on Names of Plants.[4]"

[1] MS Bursa Kursunlu 149.

[2] Max Meyerhof, *Sharḥ asmā' al-'uqqar*, "Explanation of Drug Names," in *Mémoires prés. à l'Inst. d'Égypte* (Cairo, 1940) *41*. Abbreviation = Maimonides.

[3] H.P.J. Renaud and G.S. Colin, eds, *Publ. de l'Inst. des Hautes Études Marocaines 24* (Paris, 1934). This text is more than 300 years old.

[4] MS Bibliothèque Nationale (Paris) Arabe 3004.

2. Isḥāq b. Sulaimān (903?-953?) wrote *Kitāb al-aghdhiya wa'l-adwiya*, "Book on Nutritives and Drugs.[1]"

3. Al-Tamīmī (latter part of the 10th cent.) composed *al-Kitāb al-murshid ilā jawāhir al-aghdhiya waquwa'l-mufradāt min al-adwiya*, "Guide Book on Nutritives and the Properties of Simple Drugs.[2]"

4. Ibn Jazla (d. 1100) wrote *Minhāj al-bayān fīmā yasta'miluhu'l-insān*, "Manual of Explanation in What One Employs.[3]"

5. Al-Kūhīn b. 'Aṭṭār composed the *Minhāj al-dukkān*, "Manual of the Pharmacy.[4]"

These are but a few of the manuscripts available for study. All of them, to judge from their titles and contents, were written for different purposes. In a way, it depicts the difficulty in attempting to categorize the types of pharmacological treatises written by the Muslims. Many more of these will be found noted in this book.

For further explanation of some of the processes of botanonymic study, the following are given as examples. The first is the bitter vetch or *Vicia ervila* L., in Arabic *karsanah*. Dioscorides gives this vetch, *ónobos* in Greek, as good for the belly, ulcers, gangrene, hardness in the breast, boils, and carbuncles. In al-Kindī's "*Medical Formulary*," it is used in a salve for skin spots.[5] In modern Egypt, it is used as a resolutive, emollient, maturative, galactagogue, and to facilitate expectoration in chest ailments.

The Arabic term comes from the Hebrew *karsīna* or Aramic *karšinnā*, both from the Sanskrit root *kršna*, "black," or the Akkadian *kiššenu*. The Sumerian is *ŠE.GÚ.ŠÁ.ḪAR.RA* and the Syriac is *kušnē*. This latter is close to the other Arabic term for vetch, *al-kasnā*[6] and its variations. This plant was very common in the Near East and in India in preclassical times. All of the above terms, except for the Sumerian, are cognates. In the Akkadian, the *r* has been assimilated while it still remains in the Aramaic, and in turn in the Arabic.

[1] MS München 809.

[2] MS Bibliothèque Nationale Arabe 2870.

[3] MS Leiden 1355; MS Shehit Ali 2107.

[4] MS Leiden 1360; MS München 833.

[5] M. Lovey, *op. cit.*, p. 324.

[6] *Cf.* J.A. Vullers, *Lexicon Persico-Latinum* (Graz, 1855) vol. II, pp. 835, 845; Maimonides, p. 185; I. Loew, *op. cit.*, II, pp. 481-491; R.C. Thompson, *op. cit.*, 103 ff.; Dioscorides (Wellmann) II, p. 108; Ducros, *op. cit.*, p. 75; M. Levey, *al-Kindī*, fol. 98a (Arabic).

The hellebore, *Veratrum album* L. is called *kharbaq* in Arabic. Al-Kindī has it in a recipe to kill mice since it is poisonous in certain quantities. In small quantities, the Babylonians used white hellebore for epilepsy and mania. Dioscorides has *helléboros* to expel the embryo and menstrua, kill mice, provoke sneezing, and vomiting, and for purging.

The term *kharbaq*, no doubt, comes from the Akkadian term *qarbuḫu* by metathesis of a word containing a liquid consonant. The Syriac is *ḫurbaknā*.[1]

The Arabic word for mustard, *khardal*, is cognate to the Akkadian *ḫaldappānu* or *ḫardinnu*. In Akkadian, mustard is also *ḫasisānu*, *ḫalamesu*, and *ār sanapu*. The last may have been originally Sanskrit. The Arabic cognate is *sinf* ("pod" or "husk"). The Greek *sinapi* comes from this. The Sumerian is *ḪAR.ḪAR*. The Arabic and Akkadian are also related to the Syriac *ḫardhĕlūnā* or *ḫardĕlā*. The white mustard plant, according to Maimonides is called *isfandār*, the wild type *al-ḫarshā*, and the seed *al-kḫardal*.

The mustard was employed for so many different ailments that its uses cannot be criteria or tracers for its origin. It must already have been widespread in prehistoric times, before 3500 B.C. The Babylonians used it for strangury, venereal disease, stomach, jaundice, lung trouble, swelling, the eyes and ears, and for rectal trouble. Dioscorides has it as effective for the tonsils, sciatica, spleen, leprosy, bad hearing and sight, and alopecia. In India, it was a stimulant and laxative, and was employed in rheumatic and paralytic affections. Al-Kindī prescribed white mustard for erysipelas.[2]

The Berber for mustard is *bū Ḥammū*. Today, in Iran and Iraq, it is administered internally as an emetic for narcotic poisoning. The seed is much used in many parts of the world today as a rubefacient and irritant.

The Latin generic name for mustard, *Sinapis*, probably comes from the Greek *sínêpi*. This is frequently true; Latin writers often used the transliteration from the Greek since it was easier to do so from another Indo-European language than from the Semitic Arabic

[1] I. Loew, *op. cit.*, p. 119; R.C. Thompson, *op. cit.*, p. 151; Dioscorides, IV, p. 184; Maimonides. no. 399.

[2] Maimonides, nos. 322, 400; W. Ainslie, *Materia Indica* (London, 1826) I, pp. 230, 232; Dioscorides, II, p. 154; D. Hooper, *op. cit.*, p. 92; *Tuḥfat al-aḥbāb*, no. 417.

(ṣināb). In other cases, the synonym was poorly invented when it came from the Arabic, sometimes to the point where it is unrecognizable.

A good illustration of etymological difficulty is in the case of Arabic *khūlanjān*, any one of the various species of galanga root, mostly from *Alpinia officinarum* Hance. In the ninth century, al-Kindī uses galanga as a stomachic and for the effects due to excessive intercourse. In the twelfth century, Maimonides gives the Persian as *kisrūdārū;* at this time in Arabic, it was also *al-khausarā*. *Khūlanjān* is Arabicized from the Persian *khawlinjān* which Hance regarded as from the. Chinese *kao-lian-kian* and Laufer believed from the Sanskrit *kulañja*. *Kisrūdārū* comes from *kisrē darū*, "medicine of Khusran", in Persian The eighteenth century text *Tuḥfat al-aḥbāh* contains the information that the root was brought to North Africa from India and that it is useful for the kidneys and bladder. Today, the galanga is grown in Indochina, India, and China. The lesser galanga is today used in Egypt as a carminative, aromatic, and aphrodisiac. The plant is not grown in Iran and Iraq.

From the evidence, it may be difficult to determine if galanga is from India or China. Laufer, who knew Sanskrit and Chinese, thought of the Sanskrit as the earlier. Increased knowledge of the old Chinese materia medica in the West is not likely to change this opinion which was based on philological grounds.[1]

In the comparison of botanical terminology, there are not a few cases where the Akkadian term is related to the Sanskrit thus indicating a close relationship of these two cultures in a scientific area before the arrival of the Greeks on the scene. The bitter vetch, described earlier, is one of these cases. Another case of similar interest is that of turmeric, *Curcuma longa* L., *kurkum* in Arabic.

In Akkadian, turmeric is *kurkanū* and *sapalginu*. No doubt, *kurkum* comes ultimately from the Akkadian which, in turn, is related to the Sanskrit *kuṅkuma*. However, in Sanskrit, even though *haridrā* is supposed to indicate turmeric only and *kuṅkuma* only crocus, there was nevertheless confusion as to these two botanicals. *Haridrā* gave rise to Persian *hurd*. Throughout the ancient Mesopotamian, Classical

[1] Ducros, *op. cit.*, p. 100; *Tuḥfat al-aḥbāb*, p. 411; ibn Biklārish, MS *cit.*, p. 113; R. Dozy, *Suppl. aux Dict. Arabes* (Leiden, 1927) vol. I, p. 371; B. Laufer, *Sino-Iranica* (Chicago, 1919) p. 545; Maimonides, no. 398.

and Arabic eras, this confusion persisted. The pharmacological uses are also uncertain since both of these plants were taken one for another over a long period of time.

Turmeric is indigenous in the East Indies and grows wild in Cochin China. In Bali and Java, it is called *kūnyit*. Javenese employed turmeric to facilitate childbirth, in complaints of the urethra and bladder, and in mesenteric obstructions. In Babylonia, it was employed medicinally in strangury, for the eyes, muscles, mouth, nose, and head. In India, turmeric is known as a stomachic.[1]

In Islamic times, turmeric was prescribed by al-Kindī in a preparation for gum and mouth pustules, by al-Akfānī for coughs, and by ibn al-Bayān in a poultice for moist scabs.[2]

Crocus, in modern times, is still taken for *Curcuma*, and vice versa. In Persia today, turmeric is prescribed as a stimulant, tonic, and aromatic, and in a decoction as a coolant for conjunctivitis. In modern Egyptian medicine, turmeric is an aperient, emmenagogue, and diuretic.

In the case of *kurkum*, even though there are cognates both in Akkadian and Sanskrit, the latter origin is to be preferred because of the non-philological evidence.[3]

Coriander, *Coriandrum sativum* L., is *kuzbarah* which in originally known in medicine from India. This conclusion is based on philological grounds. The Arabic *kuzbarah* and the Persian *kuzburah* are from the Aramaic *kūsbarethā*, in turn from the Akkadian *kusibirru* related to the original Sanskrit *kustumbārī*.[4] Coriander was known in ancient Egypt as *šꜣw* for head ailments; it has been found in 22nd Dynasty tombs.

Coriander, today, grows in India, North Africa, Egypt, Syria, Iran, and in the Caucasas. It is also known in Tibet and China. In Turkī, it is *yun-ma-su*, in Tibetan *u-su*, and in Chinese *hu-sui*. On the other hand, it is *celendre* in Anglo-Saxon and sometimes *coliandre*, going back to Greek.[1]

In Arabic times, al-Biṭrīq has coriander in a purgative, al-Kindī in a headache reliever using the dry leaf, ibn Bādīs in the preparation of an apricot colored *līqa*, and Ḥunain in treatment for ophthalmia.[2] Maimonides gives the synonyms as *an-naqda*, *an-na'da*, and *kazburah yābisa*. The last is the dry leaves.[3]

Today, in Egypt, coriander is a stomachic and carminative; in Iran it is used for toothache and headache.[4]

Botanonymic research is still in its infancy. That it can be a powerful tool may be seen from the results it has produced thus far. For example, the old notion that Arabic pharmacology is an almost complete version of the Greek knowledge, especially that of Dioscorides, must be radically modified. In a statistical inquiry, by botanonymic methods, into the ninth century materia medica employed by al-Kindī in his *Medical Formulary*, the results discovered contravene the usually accepted opinion mentioned above.

It was found that thirty-one percent of the names of the materia medica in this text came from ancient Mesopotamian terms. This was often through the intermediaries of Syriac, Aramaic, Hebrew, Persian, and perhaps Greek. About twenty-three percent of them came from Greek sources, eighteen percent from Persian, thirteen percent from Indian, five percent from Arabic and three percent from ancient Egyptian sources. The remainder is unknown. The Persian and Indian should, perhaps, be considered together, since intensive commercial and cultural intercourse between these two regions began in very early prehistoric times. Therefore, the Persian-Indian-Chinese and the Babylonian nomenclatural contributions are about equal; then that of the Greeks falls into third place.

Correlatively, the early Arabic knowledge of the simples came primarily from Mesopotamia and Asia. This information is further substantiated by the same type of study of a later and similar work, the *Medical Formulary* of the 13th century al-Samarqandī already

[1] M. Levey, *al-Kindī*, pp. 105, 113; R.C. Thompson, *op. cit.*, pp. 159 ff.; Ainslie, *op. cit.*, I, pp. 454-455.

[2] M. Levey, *op. cit.*, fols. 105b, 113a; al-Akfānī (d. 1348), *Kashf al-rain fī aḥwāl al-'ain* MS Ahmet III 1968, fol. 38b; al-Bayān, *Al-dustūr al-bīmāristānī*, publ. by P. Sbath (Cairo, 1933) p. 63.

[3] D. Hooper, *op. cit.*, pp. 109-110; Ducros. *op. cit.*, p. 158; M. Meyerhof, *Der Islam 6*, 263 (1915-16); Laufer, *op. cit.*, p. 315.

[4] B. Meissner, *Zeit. f. Assyriologie* (1891) 294; I. Loew, *op. cit.*, vol. III, 441 ff.; J.A. Vullers, *op. cit.*, no. 1009.

[1] Laufer, *op. cit.*, p. 299.

[2] Al-Biṭrīq, *K. al-sumūm*, MS Aya Sofya 3724, fol. 93b; M. Levey, *al-Kindī*, fols. 96a, 135a, Ḥunain, p. 181; M. Levey, *Medieval Arabic Bookmaking*, p. 29.

[3] Maimonides, p. 183.

[4] Ducros, *op. cit.*, p. 189; D. Hooper, *op. cit.*, p. 106.

mentioned, a Persian who lived in Baghdad for a time. In his work, the Persian-Indian simples accounted for fifty-four percent of the materia medica; the ancient Mesopotamian, twenty percent; the Greek, seventeen percent; the pre-Islamic Arabic, six percent; and ancient Egyptian, two percent.

It is evident from this botanical and philological examination that it was not the Greeks who were most influential in regards to the Arabs' choice of simples. The wide geographic distribution of the latter's botanicals (and also their mineral and zoological simples) indicates that their knowledge of drugs was transmitted to them from most of the then known world.

Increasingly, with time, Indian materia medica became known. With the establishment of Muslim hegemony in the Near East, North Africa, Spain, and part of India, trade with these regions prospered so that many Chinese and Indian materials found a permanent place in Muslim chemistry and pharmacology.

Babylonian influence in pharmacology upon the Arabs has not yet been given its true place. The Arab transmission of ideas and technology in ancient and medieval times is difficult to study. However, ancient Semetic scientific material, although not often found in literary works, did find its way to the Arabs by means of oral transmission, largely through commercial intercourse and the apprenticeship system. Partial evidence for this may be gleaned from the terminological richness of pre-Islamic oral literature.

The Akkadian knowledge must also have been absorbed at least in part, by the succeeding Semitic Aramaic, Hebrew, and Syriac literature and cultures. Linguistically, it was no doubt much simpler for the early Arabs to translate from the Semitic, Syriac for example, or to obtain oral material through this linguistic medium, rather than through the Indo-European group of languages. In the same way, Persian physicians and scientists, preferably gathered their science from the Indo-European Sanskrit and linguistically cognate tongues in India. In addition, the Persians, by force of the Muslim conquests, had to learn the language of the conqueror. In al-Samarqandī, for example, the simples which were originally Babylonian are large in number. A few are Persian *ābār*, lead, from Akkadian *abaru;* Arabic *ās*, myrtle, from Akkadian *āsu;* Arabic *baṣal*, onion, from Akkadian *biṣru*, Hebrew *bĕṣĕl;* Arabic *turmus*, lupine, from Sumerian *TAR.MUŠ* (? through Gr. *thérmos)* Syriac *turmᵉsā;* Arabic *ḥāshā'*, thyme from Akkadian *ḫašū;* Arabic *khardal*, mustard, from Akkadian *ḫaldappānu;* Arabic *khass* or *khash*, lettuce, from Akkadian *ḫassu*, Hebrew *khasā;* Arabic *khaukh*, peach, from Akkadian *ḫaḫḫu* and Syriac *ḫaḫḫa.*

Further study in the linguistic area is urgently needed for simples, botanical, mineralogical, and zoological, employed by the Arabs.[1] Research in this area could throw much needed light as a bridge over periods which do not have a substantial or satisfactorily revealing scientific literature for a complete understanding of scientific transmission in an era when literature is defective.

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[1] *Cf.* studies by M. Levey on al-Kindī and al-Samarqandī.

CHAPTER FOUR

LITERARY MODELS IN PHARMACOLOGY

Every age in the development of history from about 3400 B.C. on has brought forward its own written forms into which its knowledge was cast. These models have significance, up to a certain point, in that they reflect the quantity and quality, for example, of the pharmacology of the period. In various ages, the types of pharmacological writings have also been indicators not only as to the contemporary state of knowledge but they have pointed to avenues of increased learning and investigation in this area. It is the latter which will be detailed in the present discussion of the medieval textual forms in Arabic; in later chapters the contents will receive their proper consideration.

It is of interest to examine the types of literary models which antedated those of the Muslims. In the earliest scientific literature, for example, in the clay tablets of the Sumerians, the Akkadian speaking people, and later the Hittites, all written in cuneiform, knowledge was organized into list forms. In the lists, particularly those devoted to technical matters, related words were often listed together as a first attempt to organize the many accumulated facts on technology, medicine, and other ancient subject categories.[1]

The method of organizing the lists has already been related in chapter two. In further detail, there is, for instance, the *ḪARRA-ḫubullu* lexical series. This series is composed of a number of clay tablets. Tablets three to seven give the names of trees, parts of trees, products of trees, and wooden objects; tablets eight and nine give names of reeds and objects made of reeds; tablets ten to twelve give names of vessels, ovens, clay objects, hides and relevant chemicals in regard to their tanning and dyeing, objects of bronze, copper, silver, and gold; tablet sixteen contains names of stones as a kind of brief lapidary; and tablet seventeen has the names of plants. In the medical field there are, on other cuneiform tablets, lists of anatomical terms, terms for disease, pharmaceuticals, and varieties of symptoms.[1]

[1] *Cf.* M. Levey, *Trans. and Studies of the Coll. of Physicians of Philadelphia*, 4 ser., *30* (1963).

A typical disease list in Sumerian and Akkadian is given here.[2] The English translation is as literal as possible.

Sumerian	*translation*	*Akkadian*	*translation*
DUB	comes out	*šu-ú-lu*	comes up
DUB	comes out	*um-ṣa-tum*	sore
GUG.SU.GUG	increasingly light	*pi-in-du-ú*	pustule
SU.UM	flesh	*ba-šá-lu*	to rub
SU.TAB	a sickness	*um-šá-tu*	paralyzed hand
UM.DU.GA	excrescence	*ka-tar-ru*	dry rot

These lists contained not only all the known words representing technical matters or actions, but, more important, they pictured the status of the ancient type of synthesis and understanding of science and medicine.

From Greek times, there is the text of Theophrastus but his work will not be considered here since it was unknown to the Arabs until after the latter had settled, more or less, on the manner of expostulating their pharmacology. In Dioscorides' *Materia Medica*, each drug is treated separately giving its origin, description, and the pharmacological uses of the various morphological parts. It is divided into five major books : aromatics, oils, resins, and trees; animal products and sharp herbs; roots, juices, and other herbs; drugs useful for poisons; vines, wines, minerals, and stones. Galen wrote books on the strength of purgative drugs, on simple drugs, on compound drugs, on nutritive drugs, drugs which purge and improve one, and three more relating to theriacs.[3]

The medical encyclopedia of Paulus of Aegina (*fl. ca.* 640) contains much pharmacology in the seventh book on simple and compound remedies. The simples are arranged alphabetically together with their properties and uses. Paulus took his material on this subject mainly from Galen who, in turn, owed much to Dioscorides. The compound

[1] M. Levey, *Chemistry and Chemical Technology in Ancient Mesopotamia* chap. 1.

[2] M. Levey, *Trans. and Studies of the Coll. of Physicians of Philadelphia 30*, 158 (1963).

[3] G.C. Anawati, *Drogues et Médicaments* (in Arabic) (Cairo, 1959) pp. 117-118. For the Greek text and Latin translation, *cf.* K.G. Kuehn, *Claudii Galeni opera omnia* (Leipzig, 1821-33). This title comprises the first twenty volumes of *Medicorum Graecorum opera quae exstant* edited by K.G. Kuehn. The last, volume 21, is an index compiled by W. Assmann.

remedies fall into such categories as purgatives, salves, emmenagogues, antidotes, pastilles, powders, mouth salves, sweet drinks, collyria, plasters, oils, and aromata.[1]

The Muslims elaborated on the Greek classification and originated new major types of pharmacological literary models. These new approaches to pharmacological knowledge became not only more numerous and diversified but also, on the other hand, more flexible literary media. Since this literature flowered into works which considered the subject from a great variety of new directions, there resulted new ways of looking at pharmacology and new lines opened up for exploration and more detailed investigation.

Literature from non-scientific works also reveals much of the Arabic materia medica; there are many works on travel, on the *ḥisba* which related to supervision of crafts and trades and especially that part of it concerning medicine and pharmacy, books on medical biography and bibliography, botany, zoology, chemistry, the lapidaries, and many other writings.

Since the Muslims were excellent organizers of knowledge, their pharmacological texts were directed carefully along the many directions which either seemed more promising or more useful to the apothecary and medical practitioner. As a result, these treatises generally fall into more or less well delineated groups. Some of these major types of Arabic pharmacological literature are categorized here briefly. More elaborate descriptions will follow in later chapters.

Briefly, the most important kinds of treatises include :

1. Medical Formularies. These vary somewhat but they usually include chapters on the following kinds of compound drugs : myrobalan confections, electuaries, pills, aperients, pastilles, powders, syrups, lohochs and robs, gargles, collyria, suppositories, pessaries, cataplasms, oils and lotions, oral medicines and dentifrices, and pomades. In fact, this is the actual table of contents of the treatise of Sahlān ibn Kaysān's (d. 990 A.H.)[2] "Compounded drugs used in most ailments."

2. Book on Poisons. The contents may be varied as in the mentioned *Kitāb al-sumūm* of ibn al-Waḥshīya where there are unusual chapters on poisons lethal by sight, sound, odor and contact.[3]

[1] Berendes, *op. cit.*, pp. 606 ff.

[2] P. Sbath and C.D. Avierinos, *Deux Traités Médicaux* (Cairo, 1953).

[3] M. Levey, *The Book of Poisons of ibn Waḥshīya.*

3. Synonymatic Treatises. These are lists of simples usually in alphabetic order whose main purpose is to help the reader identify the drug in other languages. It may be remembered that the Muslims held sway over much of the civilized world in their Golden Age and so had to be multilingual.

4. Tabular, Synoptic Texts. It was long in the Muslim period before the information explosion resulted in books which were much too long and impossible to use by the practising physician. Abstracts were made of some treatises while others, wherever possible. were turned into tabellar works which were more accessible to quick usage. One of these was ibn Biklārish's (*fl.* 1106) work on pharmacology, his *Kitāb al-Musta'īnī*.[1] In the first column of each pair of facing pages, the following information is noted for each drug : name, Galenic nature and grade, synonyms in Persian, Syriac, Greek, Latin, and Spanish, substitute drug, its preparation, therapeutic value, and uses of the drug.

5. Lists of Materia Medica. These texts include therapeutic considerations and opinions of various writers on the subject, preparation of the drug, and description. Most of these are based on the organization and on much of the contents of Dioscorides' famous book. Nevertheless, the Arabic works are much fuller both in the number of drugs discussed and in the length of their descriptions.

Probably known more than any other writer on pharmacology is ibn al-Baiṭār (13th cent.) who followed this definitely Greek literary form. Much of his well known compilatory work, *Kitāb al-jami' mufradāt wa'l-aghdiya* "Book of Simples," was borrowed from al-Ghāfiqī (12th cent.), also of Spain. This text will be discussed in full in a later chapter.

6. Substitute Drugs. Much was written on this subject for various reasons. One was that the medieval Arab druggists practised much fraud in compounding prescriptions. Another was that many of the simples were impossible to procure when the patient was not near a very large city. Therefore, the compounder had to know of a substitute. For these two reasons therefore, such people as al-Rāzī, Māsarjawaih, and others, wrote on this topic. These books consist mainly

[1] MS Naples 287, MS Madrid 5009, MS Leiden 1339, MS Rabat 481; M. Levey and S.S. Souryal, "The Introduction to the *Kitāb al-Musta'īnī* of ibn Biklārish," *Janus 55*, 134-166 (1968).

of long lists of drugs and their substitutes, giving no reason and very little discussion.

These lists, though made up honestly, were meant to be employed when some simples were too difficult to obtain or were too expensive. Later on, the government, especially in the larger cities, was obliged to appoint an overseer of business malpractices; one task of his was to check apothecaries so that they did not compound inactive substitute ingredients in the remedies.[1]

7. Works on Medical Specialties. As separate treatises or as sections of large encyclopedias of medicine. Since these are the more elaborated and, frequently, the original versions of books in this field, they are not lacking in the description and minutiae of drugs and remedies. The less revealing manuscripts are those which are abstracts of the larger books, and generally begin their titles with words as "Abridgement," "Choice," "Fruit," and "Notebook."

As an excellent example of a specialized book, there is the "Ten Treatises on the Eye" ascribed to Ḥunain ibn Isḥāq.[2] It contains not only full descriptions of eye diseases with their symptoms but also the therapy unabridged together with discussion of the drugs with their preparation, pharmacological properties, and other attributes. The Arabic text was derived mainly from the works of Galen, much of it still in Greek at that time.

Another volume of particular interest is the *Kitāb al-tiryāq* of the Bibliothèque Nationale, MS Arabe 2964, of 595H/1199 A.D. It describes the preparation of theriacs, mostly Galenic, and gives a table of serpents and their representations and also drawings of various medicinal plants ancient physicians including Andromachus described and others.

In most of the books of al-Zahrāwī's famous *Al-taṣrīf*, a major concern is with the materia medica and their pharmacological activity. Only fragments of this text have seen print. Recently, the pharmaceutical aspects of the *Taṣrīf* have been discussed particularly in regard to the oily matters.[3]

[1] M. Levey, *Medical History VII*, 176-182 (1963).

[2] Max Meyerhof, ed. and transl., *The Book of the Ten Treatises on the Eye Ascribed to Ḥunain ibn Isḥāq* (Cairo, 1928).

[3] S.K. Hamarneh and G. Sonnedecker, *A Pharmaceutical View of Abulcasis al-Zahrāwī in Moorish Spain* pp. 77 ff.

The above classification is an artificial one designed to clarify the study of the contributions of Arabic writers in pharmacology. In not all cases are the mentioned categories mutually exclusive. In fact, there is considerable overlapping, most of the time due to a writer's particular interest or special knowledge. In regard to the works of superior physicians, for example, there was no slavish imitation of their predecessors. Meyerhof has given the titles of some early, extant, Arabic manuscripts on eye diseases [1] which include a wide variety of materia medica and indicate a deep knowledge about them. Included in the known ophthalmological treatises, are ibn Māsawaih's (777-857) *Daghal al-'ain*, "The Alteration of the Eye," the same author's *Ma'rifat miḥnat al-kaḥḥālīn*, "Knowledge of the Oculists' Examination," *Al-'ashr maqālāt fi'l-'ain*, "The Ten Treatises on the Eye," already mentioned, Ḥunain b. Isḥāq's *Kitāb al-masā'il fī al-'ain*, "Book on Questions about the Eye," Thābit b. Qurra's (834-901) *Kitāb al-baṣar wa'l-baṣīra*, "Book of Vision and Perception," Khalaf al-Ṭulūnī's *Al-nihāya wa'l-kifāya fī tarkīb al-'ainain...*, "The Aim and Sufficiency of [Instruction in Regard] to the Structure of the Eyes..." (written during the years 877-914), and others pointed in many directions and accentuations.

Thus it was that the Arabic scientific literature began to spread out more and more away from the relatively rigid forms of previous Greek works. The individual scientist increasingly wrote in the literary form which suited him and his work. To the better minds of the early Islamic period, it meant greater freedom both in writing and in scientific thinking. In a time when the movement of ideas was at a relative standstill, the Muslims came along with a new outlook, with a sense of inquiry into the old, and finally to a point where Western Europe could take over this thoroughly examined knowledge and endow its ripeness with a completely fresh approach of its own. Many of the theoretical changes have already been described. In the next chapters, the different forms of pharmacological texts will be described in some detail.

[1] Ḥunain ibn Isḥāq's "Ten Treatises...," pp. ix-xvi.

CHAPTER FIVE

THE MEDICAL FORMULARY

Among the oldest forms of Arabic pharmacological literature is the medical formulary, called *aqrābādhīn* in Arabic. In this type of treatise, there is usually a compilation of compounded prescriptions for many ailments. These are ordered under the major divisions of the treatise which are pharmaceutical forms. There is a wide range in number of these forms as treated by various authors. In the al-Kindī (*ca.* 850) formulary,[1] one of the earliest in Arabic, there is strong internal evidence that it was once ordered according to pharmaceutical forms although it is known today only in its abstract, and the forms have suffered much disorder.

Yaḥyā (Yūḥannā) ibn Sarābiyūn of Bājarmā, Arabia (9th cent.), translated a large Syriac work by Mūsā b. Ibr. al-Hadīthī and ibn Bahlūl into Arabic as *Al-kunnāsh* (Aya Sofya MS 3724). Part of it is an *Aqrābādhīn;* extant in Latin, it is called *Practica Therapeuticae* and appeared in print in Basel, 1543. In Latin, it is called an *Antidotarium.* It contains chapters on theriacs and confections, hieras,[2] cathartics, pills, troches,[3] nasal medicines, electuaries, lohochs, decoctions and infusions, syrups, gargles, oils, clysters, cataplasms, unguents, epithems, plasters, powders, sternutatories, dentifrices, collyria, conserves, and emetics.

The abbreviated medical formulary written by Sahlān ibn Kaysān and called, *Mukhtaṣar fī al-adwiya al-murakkaba al-musta'mala fī akthar al-amrāḍ,* "Précis on Compounded Drugs Used in Most Ailments," has already been mentioned.[4]

Mesue junior as he is called, or Māsawaih al-Mārdīnī (d. 1015) by his correct name, became an authority on pharmacology. In the West

[1] M. Levey *al-Kindī.*

[2] *Iyārij* is from the Greek. They are medicaments in which the dominant bitter simples are disguised with aromatics and spices, are medicinal tablets or lozenges usually circular disc in form.

[3] *Aqrāṣ.*

[4] P. Sbath and C.D. Avierinos, *op. cit.*

he was later called "pharmacopeorum evangelista." His work, *De medicinis universalibus et particularibus* [1] contains a section called *Antidotarium sive Grabaddin Medicaminum Compositorium* contaning twelve chapters, on electuaries, opiates, purgative remedies, conserves, lohochs, syrups and robs, decoctions, troches, pills, nasal medicines and powders, unguents and plasters, and oils.

A well-known example of the medical formulary, and one which owes much to ibn Kaysān above is the *Al-dustūr al-bīmāristānī fī al-adwiya al-murakkaba* of Abu'l-Faḍl Dā'ūd b.a. al-Bayān al-Isrā'īlī (b. 161). Ibn a. al-Bayān practised in the famous al-Nāṣirī hospital in Cairo. His treatise in English is called "Common Hospital Procedures with Compound Drugs." Listed as separate categories in the text are kneaded preparations, electuaries, pills, hieras, decoctions, troches and powders, syrups, emulsions and robs, gargles and medicines taken through the nose, collyria in powder and paste form, clysters, suppositories and pessaries, poultices and epithems, oils and lotions, oral medicines and dentifrices, and lastly pomades and medicines for fistulas and abscesses.

For further comparison, there is a similar medical formulary [2] written by al-Samarqandī (d. 1222). Its chapters include, in the following order, syrups and robs; stomachic confections and electuaries; pills and aperients; decoctions and infusions; clysters, suppositories and pessaries; emetics: lohochs; lozenges; powders and stomachic powders; dressings, coatings, and cataplasms; balms; collyria; poultics and aromatics powders, dentifrices, gargles and confections; snuff remedies; sternutatives, fragrances, and inhalants; bath aromarics; and hairdrugs.

Another Arabic work, by Maḥmūd b. Ilyās al-Shīrāzī (13th cent.), discusses the following forms : syrups, robs, juleps, oxymels, lohochs, decoctions, infusions, aromatic root juices, lotions and fomentations, pills, troches, *safūfs,* conserves, confections, hieras, tryphera (aromatic electuaries), cordials, sternutatories, gargles, dentifrices, cataplasms, epithems, washing remedies, eye remedies, pomades, oils, tinctural chemicals, emetics, anti-emetics, remedies for epistaxis, diuretics, emmenagogues, antisterility drugs, and others (MS Leiden Ar. 1376).

[1] Translated into Latin and published in Venice, 1471.

[2] M. Levey and N. Al-Khaledy *al-Samarqandī.*

Throughout these works there is a strong similarity in pharmaceutical forms. They are, however, not entirely alike but, to varying degrees, often display a particular idiosyncrasy or special interest of the author.

The *aqrābādhīn* may be considered to have had its organizational origin in Galen's *De Compositione medicamentorum;* surprisingly, it persisted well into the nine-teenth century as a form of pharmacological literature. In addition to those medical formularies already mentioned, some other well known texts before 1200 are those of :

1. Sābūr ibn Sahl, director of a hospital in Jundīshāpūr (d. 869), *Aqrābādhīn*, MS Munich 808.
2. Al-Rāzī, born in Raiy, *Aqrābādhīn*, MS Bodleian I, 611; translated into Hebrew in 1257, and into Latin in Venice in 1500.
3. Isḥāq ibn Ḥunain (d. 910 or 911) in the catalogue, Bodleian I, 611.
4. Sa'īd ibn Hibatallāh (d. 1101), MS B.M. Or. St. Browne 139, *Aqrābādhīn madīnat al-Salām* or *Aqrābādhīn Baghdadī*.
5. Ibn al-Tilmīdh b. Salāma (d. 1165) MS B.M. Or. 8293. *Aqrābādhīn*. This is a reworking of ibn Sahl's manuscript, perhaps the oldest Arabic formulary.
6. Al-Qalānisī (*ca.* 1194) MSS Paris 2946, 669, *Aqrābādhīn*.

Later Peter of Abano (*ca.* 1250-*ca.* 1316) popularized this type of work by taking it over into Latin. He added a supplement to the book by Māsawaih al-Mārdīnī, then over three-hundred years old. The original Arabic text is no longer extant but Peter of Abano's translation and supplement with the title *De Veneris* became a standard work in the West for the next few hundred years.[1]

Another famous Latin work patterned after those in Arabic was the *Antidotarium Nicolai* by Nicolaus Salernitanus (early 12th cent.). This Byzantine work, often called *Antidotarium magnum*, became a source book for many later pharmacopoeias and formularies in many languages.[2]

A later Latin work, mentioned to demonstrate the dependence of European pharmacology on that of the Arabs is by the commentator

[1] A. Fonahn, *Janus 14*, 347-53 (1909). For Peter of Abano's dependence on Arabic Sources see D.M. Dunlop, *Arabic Science in the West*, (Karachi, n.d., *ca.* 1965) chap. IV.

[2] *Cf.* M. Steinschneider, *Virchow's Archiv 40*, 96 (1867).

of Mesue junior, Jacques Sylvius (1478-1555). The latter's categories are very similar to that of the Arabic works.

The development of the formulary form of pharmacological text did not affect the categories of pharmaceuticals enough to change much over one thousand years of existence. In other ways it developed considerably in many directions. For example, as the years progressed, a greater variety of simples and compound remedies was to be found in the texts. Reliance on Mediterranean and local botanicals and minerals for drugs and chemicals became less and less necessary with time, for the trade routes, both overland and sea, became more easy to traverse. Commerce grew rapidly throughout the East and West during the medieval Islamic period. Some of the proof for the transmission of older knowledge to the writers in Arabic and Persian has already been discussed from linguistic evidence.

At this point it is in order to examine, in detail, the description of some of the pharmaceutical forms, the manner of their preparation, and the drugs employed. Most of the forms may be described briefly since they were in common use until the early twentieth century. Others disappeared in the previous century.

Syrup, *shurba* as generally known to the Arabic writers, was known as a juice concentrated to a certain viscosity so that when two fingers were dipped into it, it behaved as a semi-solid when the digits were opened.[1] Very often sugar and/or honey were added as thickeners and sweeteners.

Ibn Kaysān [2] gives a detailed account of the preparation of syrup :

"With regard to syrup prepared with flowers such as that of rose, nenuphar, violet, and similar ones, 4 ounces of flowers is taken after having removed the petals. It is immersed in very hot water, covered and left until macerated. A *raṭl* of dissolved, concentrated, and frothy sugar is added for every 4 ounces of flowers. The pure juice of the flowers of the orange tree is added and it is cooked on a gentle fire until concentrated. It is removed and used. When the syrup to be prepared is from the juice of fruits as the apple, quince, pomegranate, and similar ones, they are crushed in a marble or black stone mortar, the juice is removed by pressure, boiled, and made to foam. It is

[1] *Cf.* Saladin d'Ascoli of Salerno (15th cent.) mentioned by P. Guigues in his edition of al-Shīrāzī's *Kitāb al-ḥawī* (Beyrouth, 1903) p. xxii.

[2] *Ibid.*, pp. 19-20.

removed from the fire and clarified. For every 4 ounces of this liquid, a *raṭl* of dissolved, concentrated, and frothy sugar is added. It is cooked on a light fire until it has the consistency of honey. For those fruits whose juice it is impractical to obtain except by cooking, as the prune, cherry, jujube, and similar ones, they should be cooked in water to the point of falling apart, then ground and put through a sieve. Dissolved and frothy sugar is added and then it is cooked on a light fire to obtain the proper viscosity."

"Preparation of the simple oxymel syrup. Dissolve the sugar on the fire and let it froth. For each *raṭl* of sugar, put in 2 to 4 ounces of vinegar according to its degree of acidity and the taste of the patient. Its acidity should be to a small degree.[1]"

The robs, *rubb* in Arabic and *sapa* in Latin, were syrups. Often, it was the concentrated juice of the raisin, but, most of the time, by extension, the word was applied to all fruits and plants whose juices were purified and concentrated over a fire or in the sun.

"Rob of citron. Cold, dry, effective against poisons, eases the bile, pacifies the thirst, astringent, strengthens the heart, employed in collyria for a speck in the eye or a white spot in the eye. Preparation. Take the inside of a citron and express the juice into a stone pot. Cook on a small fire until it is reduced to a quater.[2]"

Further, the robs were not always used alone; when necessary, they were compounded as were simples.[3]"

"As for the robs, each one [when used] alone is stronger, but when put with sugar it becomes gentler. The robs may be put together in compounds with each other to assist in cooling [as in fevers] and in constipation. The compound is called 'robs'. It is made from apples, quince, verjuice, pomegranate, Chinese pear, lemon, sorrel, barberry, ribes, seeds of myrtle, sumach, white mulberry that is close to being unripe, and the azerole which is called *nārsinjid*. Tabasheer is added to it and also cooked gum when it is badly needed..."

"The juices of these fruits are gathered when robs are needed, and enough crystalline sugar is thrown in to make it sweet-sour. It is cooked until it is viscous... That [juice] of quince... may be mixed

[1] Ibn Kaysān, p. 20.
[2] Al-Shīrāzī, *op. cit.*, p. 15.
[3] Al-Samarqandī, fol. 8a.

with strengthening drugs for the stomach like Indian aloewood, Chinese cinnamon, rose mastix, and so on."

The word julep came from the Arabic *julāb* coming in turn, from the Persian *gul* "rose" and *āb* "water." Its viscosity was less than that of the robs. Frequently, sugar was added to it.

The julep was, in actuality, a light syrup. For example, in a prescription of ibn Sīnā, the proportions given are : 1 *mana* of sugar and 4 ounces of water are heated on a light fire and then 2 ounces of rosewater are added. In metric weights, this amounts to 794 g of sugar 132 g of water, and 66 g of rosewater. In Mesue junior's work, there are 5 parts of rosewater to 4 parts of sugar to yield a fluid which is not very viscous.[1]

In the case of lohochs, their consistency is of a paste-like nature. The composition of lohochs is variable; often it contains mucilaginous parts of fruits and roots which are boiled and then mixed with honey and almond oil.

"Lohochs are nearly always used in chest ailments [cough, laryngitis] and for the uvula. Among other things, the almond lohoch is useful to treat cough and pharyngitis. Take six dirhams each of gum arabic, gum tragacanth, starch, licorice juice, sugar, and confection, and five dirhams each of seed of decorticated quince, pip of the sugared gourd,[2] and decorticated sweet almond. Bray them all, sieve, and add some concentrated and foaming julep. Boil until it forms a single whole. Remove and use.[3]"

From al-Samarqandī, it is learned that "lohochs are moist and have a viscosity like thin sweet jelly. They are taken orally by spoon. Whatever dissolves from it is taken little by little to lengthen the period of its passage near the trachea. This is so that it may penetrate into it and the lungs by filtering through. It causes gentle flowing, of the moistures and adjusts them, removes hoarseness of the pharynx and the breathing, and whatever follows."

"Some of them are cold and used to soothe hoarseness when dry coughing occurs, and for intense delicate colds so that it is mixed with them to reduce their acuteness. As for effectiveness, they provide for the prevention and take care of swollen conditions. For this,

[1] Al-Shīrāzī, p. xxii.
[2] *Cf.* Maimonides, p. 332; al-Shīrāzī, p. 41 glossary.
[3] Ibn Kaysān, p. 23.

there are the cold mucilages. The mucilaginous and oily matters are such as fleawort, quince seed, marshmallow seed, violet [seed], purslane seed, [seed of] the two cucumbers, [seeds of] lettuce, poppy, mallow, pumpkin, almond, sesame, and their oils..."

"Some are warm and are used to ripen moistnesses, to make them milder, to cut them down, and to get rid of them. These are hyssop, iris, pine [cones], bitter almond, bitter vetch, maidenhair, thyme, pepper, long pepper, licorice root, saffron, honey, flaxseed, fenugreek, heart of the cotton seed, squill, dates, figs...[1]"

Al-Samarqandī gives a prescription with its explanation.

"Purging lohoch for phlegm. Ten parts each of flaxseed, bitter vetch, and shelled sweet almond, five parts of pine cone, seven parts of powder of crushed peeled lily root, and three parts each of gum [arabic] and gum tragacanth are taken as a lohoch with manna or crystalline sugar.

"The main purpose of the purging lohoch is that in the purging recipe, the bitter almond may be substituted for the sweets, honey, manna or sugar, licorice rob,—its sieved part—and a little pine cone. It is gathered in gum and gum tragacanth in contrast to the cleansing lohoch.[2]"

Al-Shīrāzī, in his work, does not divulge any information regarding the theory behind the use of lohochs. Recipes from his work give his idea of a lohoch.

"Lohoch of sebesten. It is effective for irritation of the throat, cough, eases the chest, is good for the lungs, facilitates expectoration, and is a laxative. Preparation. Take 200 [dirhams] of sebesten, 40 dirhams of dry *Ṭāif* raisins without seeds, 15 dirhams of parts of cassia, and cook it all with 6 *raṭls* of water until it is reduced to 1 *raṭl*. It is mashed by hand, filtered, and then a *raṭl* of white sugar is added to it. It is cooked on a fire until it becomes viscous.[3]"

The word for decoction comes mainly from the Arabic for "to cook," *ṭabakh* or "the cooked," *maṭbūkh*. Often, it is an extract from one or more sources which is concentrated to its third or fourth as a liquid.

One formulary gives a cuscuta decoction.

"It is for elephantiasis, mange, dandruff, and exfoliation of the

[1] Al-Samarqandī, fol. 23a.
[2] Al-Samarqandī, fol. 24b.
[3] Al-Shīrāzī, p. 22.

skin. It disperses phlegmatic and atrabilious humors, purifies the body, clarifies the complexion, is useful for a red face, pimples, and leprosy.

"One takes ten dirhams each of Indian and Kabul myrobalan without the stones, five dirhams each of common polypody, Meccan senna, Cretan cuscuta, lavender, and Syrian borage, twelve dirhams each of dry, red raisins without the pips, three dirhams each of seed of endive, pulverized seed of fumitory, and stripped licorice root, a dirham of cuscuta seed, a *mithqāl* of roses without stems and a dirham of fennel seeds. It is all cooked in 400 dirhams of pure water until it is reduced to a quarter. It is sieved; then there is macerated in it seven dirhams each of cassia and manna. It is filtered again and on it is thrown a dirham of sieved agaric, a quarter of a dirham of salt, and a spoonful of almond oil, and ten dirhams of sugar.[1] It may be used."

According to al-Samarqandī, "the decoctions are either soothers or purgatives for the humors... They are either roots like those of celery, fennel, iris, caper, marshmallow, licorice, sweet flag, pyrethrum, ginger, costus, leadwort, rhubarb, madder, greater Aristolochia, orchis, or seeds like those of fennel, celery, endive... or fruits like fig, raisin, date, jujube, sebesten, and others similar to them like honey, sweetmeat, and sugar."

"The decoctions are compounded of these to bring the humors to maturity, according to their types and kinds, and according to the degrees of their coldness, viscosity, and the combination of them."

"As to purgative decoctions, the rule for their compounding is similar to that for pills and aperients depending on the differences between the dose quantities and those of the decoctions. They are more gentle than the others, and softer and lighter on the natures. They are less warm and dangerous, faster in purging, and more proper for delicate mather since the strength of purging drugs is extracted from their matter by water. Thus, their dense bodies are exchanged for a gentle compound which flows in it..."

"The decoctions are compounded according to the need for them. For example, if it is desired to prepare a decoction to purge black bile from the entire body, except in the case of fevers, it is compounded

[1] Ibn Kaysān, p. 15.

from Kabul myrobalan, black Indian [myrobalan], dodder, common polypody, and lavender. Their weights are adjusted..., the correctives are added, and whatever else assists in mild purging.[1]"

The infusion, as a form of pharmaceutical preparation is obtained simply by leaving the root, seed, bark, leaf, or other morphological part of a plant or animal, or a mineral in water. This is one of the most common forms used in Yunani medicine today as it undoubtedly was in the medieval period. It is very easy to prepare since a certain concentration of the liquid is generally not sought for as in heating to obtain decoctions. Since drug assay of botanicals has been and still is difficult, the amount of the active principle is uncertain even though the dosage may remain constant. However, this may be said for all other pharmaceutical forms since chemistry and other sciences were not sufficiently developed to yield the proper information demanded of it. In Arabic, the infusion is *naqū'*.

Al-Samarqandī states, "The infusion is lighter than the decoction, and also colder. It does not acquire the heat from the fire as in the case of the decoction. That is why it is more suitable for fevers..."

"The major pharmacological action of infusions in fevers is to soften the abdomen, lower the temperature, and in other than fever cases to force out [certain] matter gently, little by little."

"The infusions are made from drugs that are found in decoctions... They are soaked in water in a measure equal to the water above it plus two or three fingers. During the day, it is placed in the sun in a bottle with a stoppered top, at night in straw and felt. It is given to be drunk after three days after it has been squeezed by hand and filtered through cloth.[2]"

The fomentation, *naṭūl* in Arabic, is a tepid decoction from botanicals to wet or moisten the head or an ailing limb. The *naṭūl* is often aromatic and is obtained by boiling the decoction for a long time. A fomentation or lotion, as it is sometimes called, is given by al-Shīrazī as follows:

"Fomentation which is useful for migraine of a melancholic origin.

"Preparation: take violet, nenuphar, camomile, melilot, blue lily, and clove in equal parts. Then boil all of it with five *raṭls* of water until it comes down to one *raṭl*.[3]"

[1] Al-Samarqandī, fol. 16b.
[2] *Ibid.*, fol 17a.
[3] Al-Shīrāzī, pp. 132-133.

The Arabic word *safūf* which was taken over into old Latin pharmacopoeias is now no longer used. It was not too popular in Arabic formularies and disappeared a little over a few hundred years ago from the old pharmacopoeias. This pharmaceutical form consists of a drug in a dry state, generally as a powder. If the powder was impalpable, then it was made slightly wet with a little liquid and swallowed that way.

Ibn Kaysān [1] gives a prescription for "a date powder to strengthen the liver and stomach and is effective for diarrhea caused by atonicity of the stomach and intestines. Take equal parts of dried date extract, colophony, false bdellium, dry coriander, Nabatean carob, dried extract of quince, dried extract of seed of myrtle, seed of Syrian pomegranate, and of mushrooms. It is all pounded coarsely after it has been roasted slightly. Then it is all mixed and used."

In al-Samarqandī, a fuller explanation is given in a chapter called "Powders and Dry Stomachics." He writes:

"Medicated powders are compounded according to the weights of their constituents only and not according to their strengths. In their admixture, another mixture is formed. And it is for that reason that they are used immediately and for what is mentioned. Another reason is the rapid deterioration [of the powders] because of softness and instability.[2] Most drugs used in medicinal powders are the dry, astringent ones. They are taken by mouth to dry the moistness of the stomach and the intestines. They relieve blockage and retention of urine...[3]"

"Seed powder for urine that burns. Thirty dirhams of shelled seed of watermelon, ten dirhams each of shelled seed of cucumber, of pumpkin, of cultivated mauve, and of poppy, three each of starch, gum tragacanth, and rob of licorice, two dirhams of henbane seed; and sugar equal to all. Three dirhams of it is taken as a powder in the late morning with violet syrup and rosewater.[4]"

"Powders which help retain the urine in cases of urinary incontinence without [causing] burning or extreme thirst.

[1] Ibn Kaysān, p. 19.
[2] Gloss. "Know that medicinal powders act perfectly from the date of preparation to two months later. They should not be used after two months."
[3] Al-Samarqandī, fols. 26a-26b.
[4] *Ibid.*, fol. 27a.

Acorn	50 dirhams
Frankincense	30 dirhams
Dry coriander	10 [dirhams]
Armenian bole	10 "
Gum arabic	10 "

Three dirhams of it is taken as a dose in the late morning and evening.[1]"

"A *safūf* to strengthen the stomach and intestines. Preparation : Take 10 dirhams of burnt pomegranate seed, three dirhams each of seed of myrtle, oak, and sumac, cumin which has been macerated in vinegar and then burnt, flour of lotus fruit, flour of sorb, burnt coriander. Nabatean carob, Syrian carob, and two and a half dirhams of *sukk* and *rāmik*, five dirhams of burnt aloeswood. They are all pulverized roughly, and mixed. The dose is five *mithqāls*.[2]

In the medieval Arabic literature, there are many kinds of confections. The word for "confection," *ma'jūn*, is from the verb *'ajana*, "to knead the flour with water to make a dough." It is difficult to establish a distinction between the confection and the electuary, *jawārish*. Some believe that the confection may be bitter or sweet, having a good or bad odor while the electuary must be sweet with a flavor and have a pleasant odor. The Arabic word *jawārish* comes from the Persian *kawārish*, "digestive." In Latin, it is *alguarisset*.[3]

Mesue junior held that the confection and electuary both have a firm consistency and that the difference between them is that the former contains sugar only when it is to be preserved for a long time. The electuary always contains it. Others believed that the confection could be brought, by heat, to a more firm consistency than the electuary.

In cases where the doughy product has been manufactured from five powders and a simple syrup or honey or a liquid resin, then the result gives a hiera or a tryphera or a theriac. The differences among these three are sometimes difficult to know. Most often, the hiera is a purgative confection and is bitter. It contains strong purgatives as colocynth, euphorbium, scammony, and aloe. The most famous hiera

[1] *Ibid.*, fol 27a.

[2] Al-Shīrāzī, p. 67 (Arabic).

[3] Al-Shīrāzī, pp. xxv, xxvi.

is the hiera picra of ancient Greek origin. It is composed of aloe, cinnamon, and other aromatics.

The tryphera is a compound, aromatic electuary containing ginger, nard, cinnamon, and other aromatics together with light laxatives as cassia and the myrobalans. Sometimes, *iṭriful* refers only to the myrobalan electuaries.

The theriac is a compound containing many kinds of drugs and aromatics. Many of the theriacs have a certain composition and were named accordingly by the Greeks.

As to why honey was so often used (and still is in folk medicines today), al-Samarqandī relates :

"Honey has favorable properties and good action. It prevents whatever is mixed with it from changing and deterioration... It is delightful and appealing... besides being nutritious, pleasant, and removes the distastefulness and disagreeableness of drugs; it clarifies and ripens the thick remainders, purifying them. Also,... it mixes with the particles of what is compounded with it, extracts its strength, and mixes them together. It ferments it in order that a second mixture will be derived.[1]"

Since there is not complete agreement in the definitions of confections and electuaries, it is useful to move closer to the actual texts. Al-Kindī gives electuaries in prescriptions as :

"Electuary for a cough caused by catarrh.

Flaxseed	1 part
Sweet raisins free from seeds	1 part
Pine seed	1 part
Root of licorice	1 part

"All are mixed after pounding and sieving. It is mixed with honey bereft of froth. It is taken in the morning and at bedtime.[2]"

Another al-Kindī prescription reads :

"Electuary that we compounded

Pine	5 parts
Gum tragancanth procured from just under the bark	2 parts

[1] Al-Samarqandī, fol. 9b.

[2] Al-Kindī, p. 124.

Crystalline sugar	7 parts
Sijistan sweetmeat	3½ parts

"All are pounded until the mixture becomes like honey. Then water is admixed. The dose is one to one and a half dirhams. It is useful for a cough that is due to phlegm attached to the lung."

Al-Samarqandī writes :

"Those electuaries whose rules of compounding are well known and whose drugs are available and tested by our contemporaries are the myrobalan confections [sic !]. The word *iṭrifl* is arabicized from the Indian language in which it applies to chebulic, belleric and emblic myrobalans. The three of them strengthen the nervous organs, and aid the organs of nutrition in regard to waste excesses... They are made up in equal weights since their strengths and usefulness are the same.[1]"

Electuaries, in al-Samarqandī's *Aqrābādhīn*, are employed for many purposes :

"Electuary of purging cassia for hot colic, bilious elements, and phlegm in the intestines.

Isfahan violet	40 dirhams
Turpeth	40 dirhams
Indian salt	7½ dirhams
Fennel seed	5 dirhams
Anise	5 dirhams
Mastix	5 dirhams
Licorice rob	2 istars
Scammony	15 dirhams
Pods of purging cassia	100 dirhams

"It is weighed after being sieved and then gathered with the pulp of the purging cassia and 100 dirhams of sugar candy. The dose is five to ten dirhams.[2]"

Prescriptions for a cumin and aloeswood confection in al-Samarqandī show that these were also sometimes sweetened with sugar.

"The best is the aloeswood confection. It strengthens the stomach and warms it quite well. It is mixed with a *raṭl* of sugar, two dirhams

[1] Al-Samarqandī, fol. 9b.
[2] *Ibid.*, fols. 11a-11b.

of pulverized Indian aloeswood. It is placed over a fire. To it are added saffron, clove, cardamon, and so on, one after another. The sum total depends on the need. It may be mixed with lemon rob in a quantity to make it pleasant. Lemon juice may be used instead. It is yellow and pretty.[1]"

Fragrances, in confections as used by al-Samarqandī, are for warming of the stomach, to remove moistness, and to aid digestion of the excess. Included in the fragrant materials are ginger, clove, cardamon, rose, musk, cinnamon, nard, thyme, basil, and others. "Binders may be added to it [to make it more viscous] such as myrtle seed, wild pomegranate flower, tabasheer, and so on. It is gathered in quince pulp softened by cooking in syrup or in vinegar, and made viscous with crystalline sugar.[2]"

Ibn Kaysān [3] describes confections without sugar. One reads :

"Cordial confection. It is indicated for palpitations, heart diseases, and ailments of the stomach if they are caused by chilling.

"Take five dirhams each of cinnamon, clove, Chinese cinnamon, and odoriferous nard, ten dirhams of lichen, Syrian bugloss, wild pomegranate flower and ocimum, three dirhams of saffron and lentisk. It is all pounded, sieved, and kneaded with three times its weight of honey of viscous emblic myrobalan, It is removed and the dose is two to three *mithqāls.*[4]"

In order best to describe the hiera, a prescription is given from ibn Kaysān :

"Compounded hiera.[5] It is a remedy with multiple benefits, of great value, and without danger. It facilitates evacuation of heavy phlegmic secretions from extremities of the body without violence. It is useful for ailments of the head as headache, migraine, leucoma, vertigo, obsession, epilepsy, deafness, hemiplegia, chronic pain of the eyes and ears, to free congestion of the liver, strengthen the stomach, facilitates menstruation and makes dyspnoea go. It is useful for asthma and all phlegmic and bilious aliments as quartan fever, pains of rheumatism, gout, sciatica, alopecia...

[1] *Ibid.*, fol 12a.
[2] *Ibid.*, fol. 12b.
[3] Ibn Kaysān, p. 9.
[4] *Ibid.*, pp. 46-47.
[5] *Lūghādiyā* or *lūghādhiyā* in Dozy II, p. 558.

"Take five dirhams of colocynth pulp, and 4½ dirhams of burnt onion, agaric, scammony, black hellebore, gum ammoniac, wild thyme, and three dirhams each of Cretan cuscuta, germander, false bdellium, Socotran aloe, thyme, Indian nard, horehound, cassia, black pepper, white pepper, long pepper, saffron, Chinese cinnamon, opoponax, sagapenum, castoreum, myrrh, extract of absinthium... It is pulverized, sieved, then mixed with 3 times its weight of frothy honey. The dose is 4 *mithqāls* 4 months after its preparation.[1]"

The tryphera is a confection which includes the three types of myrobalan, chebulic, belleric, emblic. Ibn Kaysān gives the recipes for the small and large trypheras.

"Prescription for the small tryphera. It is for atonicity and hypersecretion of the stomach, to activate digestion, diminish and evacuate the humors formed in the digestive organs, to stop the gas given off by the stomach from reaching the head by strengthening the pylorus, strengthening the senses by its specific effect, rendering the spirit lucid, increasing intelligence and the acuity of understanding. It is efficacious against amnesia and torpor, and strengthens the nerves. It makes well one with humid and cold cerebral illness because of its strengthening and astringent effects on the functioning of the brain, and stops the whitening of hair.

"Take one part each of chebulic, emblic, and belleric myrobalans without the stones. It is pounded but not powdered. Its dust is taken up with fresh butter of a cow or oil of sweet almond. It is kneaded with 3 times its weight of honey, bereft of froth. It is removed and the dose is 3-5 *mithqāls*. Some add to it the yellow and Indian myrobalans.[2]"

The subject of tryphera in al-Samarqandī is discussed in the chapter on confections and electuaries. The five myrobalans mentioned by ibn Kaysān are pulverized and immersed in ghee or almond oil "to destroy the strength of its dryness. This is because dryness is harmful to the digestive forces... The belleric myrobalans which has been soaked in milk so that its dryness disappears is *shirāmulaj* ...The honey should be double the amount of the drugs in myrobalan confections ... or it may be three-fold so that it may be warmer, gentler, and less unpleasant.[3]"

[1] *Ibid.*, p. 51
[2] *Ibid.*, p. 45.
[3] Al-Samarqandī, fols. 9b-10a.

The theriacs are among the most complex of Arabic pharmaceutical forms not only in the generally huge number of ingredients but also in the time consuming processes of manufacture.[1] Some of them, however, are brief and may have but a few constituents.

Theriac is a loanword from the Greek. Jābir discusses theriacs for various purposes.[2] Al-Shīrāzī gives a special theriac.

"It is effective against poisons. Preparation : take 50 dirhams of dry fig, 30 dirhams of dry leaf or fue, 20 dirhams of wild garlic, 10 dirhams of salt, it is pulverized, sieved, and kneaded with crushed figs. The dose is 3 *mithqāls*. It must be used without delay.[3]"

Al-Shīrāzī [4] was interested in determining the proper dosage of a theriac after it was made up. "The trial is conducted in two ways. First trial. A man takes a strong purgative as colocynth, scammony, or a similar drug. Then one gives him about one-half dirham of theriac. If the effect of the purgative drug is blocked after having commenced, then one must conclude that the theriac is good and active... Second trial. One gives one-half dirham of this theriac as a food to a wild cock. Then one causes the cock to be bitten by a snake. If the cock does not die, the theriac is not spurious but it is excellent; otherwise, it is bad and weak."

Another of the lesser known confections is the cordial, *mufarriḥ* in Arabic. This is used for the heart; its distinction is that it contains a precious simple as gold, silver, precious stones, and pearl which has not been pierced. In modern Pakistan and India, it is still possible to procure a native sandwich with very fine silver foil in or around it. The purpose of the cordial is to exhilarate a person, to make him happy, or simply to help preserve his health.

Sternutatories are medicaments which are not of any particular pharmaceutical form but are usually, nevertheless, in a separate classification. They may be classified into two kinds, 1. *sa'ūt* which is any remedy taken through the nose, and 2. *shamūm* which is an odorant or inhalant.

Al-Kindī, as did others, had the idea that nasal medicines penetrated

[1] Al-Kindī, p. 267.
[2] Jābir, pp. 171a, 176b, 188b, etc.
[3] Al-Shīrāzī, p. 149.
[4] *Ibid.*, p. 196

into the head. With this in mind, he, therefore, has the following prescription.

"A nasal medicine for a big head, an enlarged child's head. It is sharp, penetrating, and proved.

Gall of a crane	1 part
Gall of an eagle	1 part
Gall of *shabūt* fish	1 part
Castoreum	1 part
Callus of a horse	1 part
Fennel	1 part
Saffron	1 part
Crystalline sugar	2 parts

"It is pounded, sieved, and kneaded with extract of moist fleawort seed. An amount in pill form as large as a lentil is taken and dried in the shade. For three days every month this amount in cold water is sniffed up daily. The head is measured with a thread and the length noted. When the new moon appears, it is measured again. You will find it decreases until it returns to its normal condition.[1]"

In al-Samarqandī, a chapter is devoted to nasal medicines, sternutatives, fumigants, and odorants. He writes :

"The drugs which are used as fine powder in the nose are snuff medicines. They may be used as drops or they be hot and dry and injected to get rid of phlegmatic remnants from the brain, open blockages of the head, heat its humor at the end of cold diseases like epilepsy and migraine, for distortion of the mouth, cold hemicrany, and so on.

"It is made from castoreum, sal ammoniac, turpeth, black cumin, harmel, aloe, garum, opopanox, borax, thyme, black and white pepper, gum ammoniac, asafetida, euphorbium, musk, pyrethrum..., gall of a bird, urine of the camel, onion juice, marjoram, rue, beet, vinegar, oil of bitter almond.[2]"

"Nasal remedies are used in a blower to open the nostrils to smell and to get rid of cold remnants from them.[3]"

"Some [of the drugs alone] are fumigants resembling incenses,

[1] Al-Kindī, p. 44.
[2] Al-Samarqandī, fols. 37a-38b.
[3] *Ibid.*, fol. 37b.

either moist or dry. The hot moist fumigants are used to open the nostrils and to soften the [dried] mucous..."

"The fumigants are also used to open the orifice of the ear, to loosen the matter and dirt, and to dissolve the [ill] odors. [The materials in the fumigants] are cooked in a gourd bottle whose spout is held near the nose or ear. Or it may be poured on directly. Salt and vinegar may be added according to the need. The fumigant may be used with syrup and with preserves...[1]"

"Dry fumigants are smokes which strengthen the head and brain; they are musk, aloe, sandalwood, costus, ambergis, and *sukk*.[2]"

Odorants are used to moderate the humor of the cold brain. They are either aromatic plants or perfumes, or grasses, or non-grasses, or fruits. They are vapors as the following :

"Vapor for hot hemicrany. Violet, nenuphar, marshmallow stems, bruised shelled barley, pumpkin, and watermelon rinds. These are all poured into a basin; then some violet oil is thrown on it. One leans over it.[3]"

Some formularies consider the aromatic bath as a separate form. The bath is used so that the patient may inhale the drug vapors more easily. The entire body is not immersed in the drug but as al-Samarqandī states :

"Aromatic baths are made of drugs which are volatile under ordinary conditions, hot or cold, cooked in water, filtered, and poured on the head from a distance. They are for certain diseases. The vapors and their dissolving drugs must not be prepared from astringent sternutatives because of the importance of the brain and its significance in order to keep its strength and its functions from weakening.

"The drugs are cooked in flasks whose tops are covered to retain the gentle parts which penetrate the pores quickly. The aromatic baths are preferred for this rather than others.[4]"

"Aromatic bath useful for lethargy and cold hemicrany.

Camomile	[1 part]
Aneth	»

[1] *Ibid.*, fols. 37b-38a.
[2] *Ibid.*, fol. 38a.
[3] *Ibid.*, fols. 38a-38b.
[4] *Ibid.*, fols. 38b-39a.

Wild thyme	[1 part]
Marjoram	»
Mountain Mist	»

"They are cooked, filtered, and used to wash the head.[1]"

Gargles were often discussed in separate chapters in medical formularies. In al-Samarqandī, there is a fairly good definition :

"Gargles are either to make the hick humors in the head gentle and ease them down by way of the mouth, or to prevent the thin ones from coming down thickening them and narrowing the duct. They are also used for swellings of the throat.

"...they are woods from such drugs as pyrethrum, ginger, thyme, barberry, sweet flag, mustard, mountain mist, rind of the caper root, iris, borax, pepper, marjoram, serpolet, hiera, juice of honey, and garum, or oxymel of sugar, of honey, or of onion.[2]"

Ibn Kaysān gives a gargle, *gharghar*, to clarify the brain and useful for epilepsy, apoplexy, facial paralysis, and for cold rheumatism. "Take 5 dirhams each of piqra hiera, sweet flag, staphisagra, mustard, pyrethrum, ginger, and fennel flower, mint, thyme, root of the blue lily and rind of the celery root. Pulverize it all and sieve it through a silk cloth. Mix with the best oxymel and gargle with it.[3]"

The mouthwash, in many *aqrābādhīns*, is often described under gargles. Al-Shīrāzī gives a common mouthwash :

"It is useful for heaviness of the tongue. Preparation. Take ginger, pyrethrum, pepper, and mustard in equal parts. Pulverize and sieve. It is applied to the tongue many times per day.[4]"

"A mouth rinse for thrush. Preparation. Take 1 part of dry coriander, 1 part of peeled lentil. It is pulverized, sieved, and mixed with coriander juice. The mouth is rinsed with it.[5]"

Among the most common types of medicinals, the dentifrices are sure to be found in all medical formularies. There must have been much trouble with the teeth. The dentifrices are not new forms but seem to be commonly grouped together. The structure of most Arabic

[1] *Ibid.*, fol. 39a.
[2] *Ibid.*, fols. 36a-36b.
[3] Ibn Kaysān, p. 25.
[4] Al-Shīrāzī, p. 83.
[5] *Ibbid.*, p. 83.

medical formularies is an uncertain one; in most there are two kinds of prescriptions, one related to the form of pharmaceutical and the other devoted to certain ailments as the teeth, eyes, and stomach. Some *aqrābādhīns* contain more of one grouping and some less. There is a great variation in the proportion of these. The dentifrices, of course, are an example of the medicinal rather than the pharmaceutical form of grouping. These differences showed up early as in al-Kindī and persisted past the late medieval period. Some of al-Kindī's prescriptions read :

"Another dentifrice which strengthens the gums, is good for the mouth and purifies it. Saffron, camphor, cardamon, acacia, pyrethrum, aloe, turmeric, crystalline sugar, and yellow myrobalan are in equal parts. All are mixed after sieving with a silk cloth. Then the teeth are covered with it from the outside and inside. It hardens and strengthens them immediately.

"Medicine with which one anoints the teeth. They are sweetened and the gums are strengthened.

"Barley water is kneaded with tar. It is placed in the oven until it is dry. The red color changes to black and it is not burned much. Ash of false bdellium is kept in the furnace until heated to hardness. Ten parts of each are used. They are mixed well with one part of Meccan henna, one part of yellow alum, and one part of Darānī salt after sieving with a silk cloth. It is applied and is useful.[1]"

Frequently to be found in medieval dentifrices were powdered carbonates from sources as coral and different kinds of ash. Aromatic drugs were common in the powders. Pyrethrum, mint, and the astringent alum were, and still are, common ingredients of tooth powder in many places.

A cataplasm, *ṭilā'*, is difficult to distinguish from an epithem, *ḍimāda*. Gerard of Cremona translated the latter as cataplasm in the Latin *Aqrābādhīn* or *Antidotary* of Serapion. A cataplasm frequently, in medieval times, was a powder mixed with a little water and then coated on a part of the body. When the remedy in powder form was mixed with a little oil and then applied, it was sometimes called an epithem.[2]

[1] Al-Kindī, p. 118.
[2] Al-Shīrāzī, p. XXVIII.

Al-Samarqandī does not agree with the classification of cataplasm and epithem. He writes :

"Dressings are compounded remedies which have the consistency of electuaries. They are applied to exposed members and made to adhere to them. Coatings are thinner in consistency in such a way that if the members are anointed with them, they stick and spread over the surfaces. They do not need to be bandaged or bound on. Coatings are gentler and faster in penetrating and dissolving. The dressings are thicker and more of it stays on the limb..."

"The cataplasms are either wet or dry. The wet ones are like bladders which are filled with hot water or cloths which are saturated with hot water, then put on the members to warm them and to moisten them... Some are relaxants and resolvents like marshmallow, aneth, willow, melilot, camomile, violet, marjoram, and so on."

"The dry cataplasms are like heated salt, sand, common millet, bran, ashes, and so on; they are heated and put on the members to warm and dry them. All cataplasms are used to quiet pain. The dry one is better for rheumatic pain and cold matter. The wet one is preferred for stinging pain and sharp matter..."

If the special wax and oil mixture is to be used with the drugs, then a plaster is formed.

Some examples of the above forms are given from al-Samarqandī :

"Coatings used in warm swellings. They are made from the two sandalwoods, areca nut, horned poppy, rose, camphor in vinegar, rosewater, juice of coriander, and lettuce."

"If it is for the liver, it is black nightshade, juice of endive, and juice of quince."

"As for the ripening of abscesses, this is done by soft, sticky coatings like flaxseed, fenugreek, figs, yeast, and so on."

"The application for a fracture, dislocation, and a bruise is made from wild pomegranate, cypress, myrtle, flour of the mungo bean, lentil, Armenian bole, acacia, the two sandalwoods, areca nut, glaucium, *būsh*,[1] and marshmallow."

"Ointments for skin diseases and their coatings. For whatever may be attached to the hair, nails, or skin, one uses something which goes with olive oil to make it clear like asphodel, mustard, soapwort,

[1] An eye remedy brought from Dar-band; also an Armenian cataplasm (Dozy 127). Ibn al-Baiṭār has *būsh Darbandiy* as a plant used for gout.

euphorbium, jellyfish, burnt bark of the fig tree, black cumin, thapsia, sesame oil, vinegar, arsenic, *naft*,[1] *qunābarā*,[2] and so on."

"Application for the neck. Mastix, shell of frankincense, cypress nut and leaf, myrrh, savin,[3] sarcocol,[4] asphodel, and fish glue are taken in equal portions. The glue is dissolved in vinegar; collected with it are seed of lettuce, opium, and mandrake. It is daubed on the forehead. The poppy used had been cooked.[5]"

The epithem of al-Shīrāzī resembles the balm of al-Samarqandī. This consists of the required compounded remedies with oil. A more simple one from al-Samarqandī's text reads :

"Costus balm is useful for epilepsy. One ounce of costus, 1/3 ounce of pepper, 1/3 ounce of pyrethrum, 1/3 ounce of euphorbium, and 1/2 ounce of castoreum are dissolved in 1/2 *raṭl* of oil of yellow gillyflower or oil of narcissus. The atonic organs were rubbed with it.[6]"

The elaborate distinctions of later pharmaceutical forms is not to be found in the early al-Kindī *Aqrābādhīn*. Thus, the pharmaceutical forms of applications to the body are not emphasized as in the later formularies. Some of the al-Kindī applications are given :

"For a boil or ulcer on the head. Dust which is deposited in fodder and ashes soaked in rosewater. Daub the boil with it. It will disappear and hair will grow. It is a tested remedy.

"Poultice to open an abscess. Pulverize core of the cotton seed, pigeon dung, and Syriac glass in equal parts and mix with sesame oil or rose oil. Then bandage the swelling with the mixture. It opens with speed.[7]"

"Effective ointments used nasally. Red sandalwood is rubbed with extract of garden nightshade and one-fourth as much pulverized betel nut and an amount of well pulverized white flour equal to double the betel nut, and rose oil. One anoints with it.[8]"

[1] Naphtha, according to al-Zahrāwī, is of two types. One is natural and flows from springs, is black, putrid, and white after it rises. The other is manufactured from certain oily substances (S.K. Hamarneh and G. Sonnedecker, *op. cit.*, p. 84 Ar.)

[2] Some kind of pot herb or moss. See al-Samarqandī, p. 227.

[3] See al-Samarqandī, pp. 208, 244 for *abhul*.

[4] See al-Samarqandī, p. 213 for *'anzarūt*.

[5] Al-Samarqandī, chap. 10., *passim*.

[6] *Ibid.*, fol. 30a.

[7] Al-Kindī, p. 68.

[8] *Ibid.*, p. 74.

"Poultice for the liver.

Clear rose oil	1/2 *raṭl*
Beeswax	15 *istars*
Red sandalwood	4 dirhams
Yellow sandalwood	4 dirhams
Rose	4 dirhams
Camphor	1 carat

"The oil of rose is poured into a stone cooking pot and placed in a smith's furnace. It is heated until it becomes dry. The wax is crumbled into it. When the wax is melted, the drugs are thrown on. It is taken from the fire and the camphor and pulverized mixture are sprinkled on. It [the liver] is anointed.[1]"

In the above recipes of al-Kindī, the finished products vary from those liquids with a low viscosity to a powdered solid. There is much leeway in the type of application to be used in al-Kindī. In later *aqrābādhīns*, the categorizations seem to be more fully developed.

Some of the most common ailments in ancient and medieval times concerned the eyes. In Arabic works, the *shiyāf* and *kuḥl* as remedies are found in nearly all works on medicine. The *shiyāf* was an ophthalmic drug which was stored as a tablet. In al-Kindī, there is a prescription which shows this:

"Abū Ghālib's collyrium aids and sharpens the sight.

Good dry Chinese ginger	1 dirham
Unripe grapes	2 dirhams
Leopard's bane, called *darsūnaj* used for dyeing garments	3 dirhams
Yellow myrobalan	4 dirhams

"These are the weights after pounding and sieving... When it is necessary to use it, it is put with rain water. When it softens, its liquid is used as a collyrium.[2]"

Most of the time, the *shiyāf* was used mainly to give a glitter to the eyes. The collyrium, *kuḥl*, on the other hand, was meant to cure illnesses of the eyes. In the older texts, as in Ḥunain ibn Isḥāq's "Ten

[1] Al-Kindī, p. 80.
[2] *Ibid*,. p. 166.

Treatises On The Eye,[1]" a work devoted only to ophthalmology, *kuḥl*, refers to a dry substance, or "powder for the eyes." In later times, it refers mostly to antimony sulfide or another antimony compound used to darken the edge of the eyelids, in the Near East.

"Collyrium. Remedy for fatigue and watering of the eyes. It is good for the eyesight and itching. It draws out the excess.

Hematite	12 dirhams
Verdigris	6 dirhams
Burnt copper	4 dirhams
Burnt vitriol	4 dirhams
Opium	1 dirham
Saffron	1/2 *mithqāl*
Gum arabic	10 dirhams

"The haematite and burnt copper are weighed and washed. The weights of the drugs are measured after sieving. The opium is filtered with water, mixed with vinegar and then kneaded with the drugs.[3]"

In the later period of al-Samarqandī, the types of eye medicines are much increased. Al-Samarqandī himself writes:

"Eye medicines. These are antimony powders and collyria. Of these, there are coolants, powders, and drops. Then, there are dressings and embrocations. The latter two are used at the commencement of eye swellings and the flowing of matter. They are the preventive embrocations..."

"When there is need for a slight resolvent, one may... use also dry coriander, melilot, flaxseed and *ka'k* biscuit; need for greater dissolution ... requires that the drugs be collected with syrup. It is poured out in the vapors of marjoram, camomile, dill, and red fig...[3]"

"Drops are the softest eye medicines. They are to be preferred for use in the case of swellings at the beginning and in inflammation. [Their use] cannot approach the hardness of the style and its weight.[4]"

Al-Samarqandī, in ophthalmia, used sich materia medica as white of the egg, mucilage of fleawort, mucilage of quince seed, a young girl's milk, and others.

[1] Ed. by M. Meyerhof (Cairo, 1928).
[2] Al-Kindī, p. 162.
[3] *Ibid*., fol. 30b.
[4] Al-Samarqandī, fol. 31a.

The remaining therapeutic types and pharmaceutical forms will be described briefly.

Clysters are either rectal or urethral. The *ḥuqna* or clyster is composed of compound drugs in water, often with aromatics and oils added.

"A clyster introduced into the urethra is an effective remedy for the dripping of urine, its strong odor, and calculi.

Aquatic costus	1 *mithqāl*
Male frankincense	1 *mithqāl*
Castoreum	1 *dāniq*
Musk	1 *dāniq*
Pure mercury	in sufficient measure

"These drugs are boiled after sieving with the mercury. It is then poured into the urethra.[1]"

The suppository and pessary used were described in the old Arabic formularies. Al-Samarqandī's text does not show much change from the older ones. He retells the oft told origin of clysters.

"It was first known from a bird with a bent beak which eats so much that he injects sea water from his beak into his rectum when his stomach is full. He continues so until it is emptied.[2]"

An interesting description of the construction of one type of clyster is given by al-Samarqandī.

"The length of the tube should be that of a small span to a hand span. The width should be equal to that of the small finger. The inside is divided into two parts, a small and a large, their ratios one-third to two-thirds. The duct of the smaller allows the air to leave, and the larger permits the clyster solution to enter. The smaller one should not extend to the farthest wide end of the larger but it should be slightly shorter in such manner that when the skin is tied on, the opening of the smaller tube will not interfere with the skin but, on the other hand, they go together beside each other to the end. The smaller may have another hole on the side of its tube near its top so that wind may enter into the duct. It may be two holes for if one of them is blocked by something, then the other will take its place. If the larger tube has a hole like this, it will be much better and safe [to prevent] obstruction of the enema during the clystering, and

[1] Al-Kindī, p. 160.

[2] Al-Samarqandī, fol. 19b.

the exit will be safeguarded when the straight hole has something at its entrance or meets compressed matter.[1]"

"The quantity for a clyster is from 1/2 to 2/3 of a *raṭl*. It is administered lukewarm to warm. The abdomen is given the liquid in such a manner that it does not go haphazardly. The body should be inclined toward the site of the illness and pain.[2]"

Clysters were used not only as laxatives, as one may have surmised from the previous paragraph, but also for sciatic illnesses in the thigh, to heat the back, as a carminative, to break the colic, for treatment of the hip, to warm kidneys, to aid the intestines and stomach, and for other organs not far from the rectum and colon.

"The preferable way and the best to administer a suppository is to tie it with a string so that it may be extracted when the pain decreases. Some may be taken as a pessary or as a suppository to cause the menstruum or hemorrhoids to flow or to block them."

"To close the openings of veins, and bring about retention, use *kuḥl*, gallnut, alum, acacia, borax, frankincense, and pomegranate blossom... These are all mixed together with gum arabic and made into small suppositories like the seed of the service tree.[3]"

Oily matter, *duhn*, is usually in a prescription containing one or more oils. There are three types which oily matter subsumes. First, there is the macerated dry materia medica in oil. Second, drugs may be cooked in oils to procure, for example, oil of myrtle. Third, there is enfleurage, a process in which aromatic botanicals are soaked in oil so that the latter may dissolve the oil soluble odorants, as for violet oil. If desired, this mixture may be treated to concentrate the aromatic further.

The oil remedy is well described in al-Zahrāwī. From his *Taṣrīf*, there is the oily remedy of laurel.

"The preparation of its oily remedy is known well. Most of this oily remedy comes from the West near Ceuta since many [laurels] are there. The ripe seeds of laurel are pulverized, put into a large vessel, water is poured over it, and it is covered. It is then cooked over a gentle fire until the oil matter appears above the water. It is collected carefully."

[1] *Ibid.*, fols. 19b-20a.

[2] *Ibid.*, fol. 20a.

[3] *Ibid.*, fols. 21b-22a.

"Another preparation is to take five *raṭls* of *rikābī* oil and one *raṭl* of laurel seed. It is pounded and cooked well with the oil. It is pressed, extracted, and removed.[1]"

Vomitives are not, in the full sense, emetics. They are, in the medieval Arabic meaning, oily substances which make one vomit. Many kinds of emetics were prescribed for specific purposes as to vomit phlegm, yellow bile, black bile, poisons, and so on.

"To vomit black bile.

Indian salt	1 dirham
Yellow turpeth	1 dirham
Borax	1 dirham
Khark	1 dirham [2]

There are also anti-emetics which contain, among other simples, aromatics and astringents such as coriander, mint, sumac, and others.

A pharmacist's handbook which greatly influenced Arabic medicine and is still very popular mainly outside the large cities is that written by al-Kūhīn al-ʿAṭṭār meaning the druggist priest or Kohen the druggist. In 1259, he wrote the treatise, "Manual for the Pharmacy," as previously mentioned, for his son. Most of it is concerned with beverages, robs, conserves, nacrotics, and electuaries. The remainder which covers all other aspects of the drug business of the time discusses deontology, weights and measures, synonyms, how to collect and preserve herbs, the provenience of drugs and how to test simple and compound drugs. Al-Kūhīn, a practising apothecary, was a contemporary of ibn al-Baiṭār and may have been in touch with him.

Many other lesser groups were described in medieval formularies as diuretics, emmenagogues, antidotes, remedies for sterility, aphrodisiacs, sudorifics, and hair medicines. The emphasis upon purposes of the remedies indicates the concern of the people with the more common symptoms. It was, as a result, not difficult to choose a remedy from a vast number of them in a general handbook. With few exceptions, the underlying cause was not attacked. The very nature of the composition of the *aqrābādhīn* did not allow much concern for syndromes which occurred commonly since so much was focused on the remedy

[1] *Cf.* S.K. Hamarneh and G. Sonnedecker, *op. cit.*, p. 82.
[2] Al-Samarqandī, fol. 23a.

for a single pain or sign. There is evidence that this was recognized in medieval times, for it was then known that certain syndromes were equated with certain recognized ailments or diseases. The latter, however, were not quite numerous enough to develop a medical science based less strongly upon treating isolated symptoms. This statement will be borne out by study of other kinds of Arabic pharmacological literature.

CHAPTER SIX

LISTS OF SIMPLES

In an earlier chapter, it was pointed out that lists of botanicals and simples were already well known in the earliest literate period. This was in the ancient Mesopotamian lexical tablets. Theophrastus of Eresos (d. *ca.* 285 B.C.) wrote "Enquiry into Plants." Then came "Materia Medica" of Dioscorides, composed about 78 A.D., which has already been discussed. Although it was organized into five books and within these books there is some attempt at classification, it is not alphabetical and so loses some of its direct value to the practising physician. Nevertheless, because of its early translation into Syriac, and then into Arabic, first by Stephanos, son of Basil (first half of 9th cent.), then by Ḥunain ibn Isḥāq, and later in Spain by a commission of the Jewish minister Ḥasdāi ibn Shaprūṭ (915-*ca.* 980),[1] it was very influential.

A typical description of a drug by Dioscorides follows :

"Calamintha. Some of it is wild and has leaves like those of Ocimum, whitish, but sprigs and stalks angular, and a purple flower. The other kind is like Pulegium, yet greater, whence some have called it Pulegium agreste since it resembles it in smell. The Romans call this Nepeta. The third kind is like wild mint, has longer leaves, and is larger in stalk and branch, but less effective. The leaves of all of them are strongly warming and sharp in taste. The roots are useless. It grows in plain and rough fields, and in watery places. Administered orally or externally, it helps one bitten by a serpent and when drunk is a diuretic. It also helps ruptures, convulsions, orthopnaeas, tormina, choler, and rigor. When it is drunk with wine beforehand, it is effective against poisons and cleanses away the icterus. When pulverized, either sodden or raw and it is drunk with salt and honey, it kills roundworms and ascarides. When it is eaten and then followed by milk whey, it helps in elephantiasis. When the leaves are pulverized and put into a pessary, it is an abortive and expels the menstrua. When

[1] *Cf.* C. Dubler, *La Materia Médica de Dioscórides* (Barcelona, 1953-54) 6 vols.

it is suffumigated or strewn under foot it drives serpents away. Soaked in wine and applied, it makes black scars white and removes black and blue spots. It is applied for sciatica... and its juice dropped into the ears kills worms.[1]"

It may be noticed that the degrees of the qualities of the simple are not mentioned since it was not until Galen that the idea was popularized. An alphabetical rearrangement of Dioscorides together with various accretions was written before the time of Oribasius (325-403). It was this recension from composite sources which Oribasius used. The Julia Anicia text was derived from a version of Dioscorides.[2] In this fourth century arrangement, all simples are alphabetical ignoring the order of the Books. In the ninth century, the five Books were preserved but the simples were organized alphabetically within these Books.

Galen of Pergamum (*ca.* 129-200 A.D.) is responsible for giving the alphabetical list of simples to the Arabs, a form which maintained enormous popularity throughout the entire period from the second century to the nineteenth.[3]

It is Galen's work, originally dependent upon Diophantos, which served as a foundation upon which many Arabic authors on pharmacology built. The "Simple Drugs" of Galen was translated into Syriac in the ninth century by Yāsuf al-Khūrī and also Ayyūb. Again, in the early ninth century, *ca.* 840. Ḥunain ibn Isḥāq translated it again into Syriac and then into Arabic. Syriac is not too difficult a language for a literate Arabic writing physician to read and so Galen's work, in Greek, Syriac, and Arabic, was available at an early date for the medical world of the time. It may be remembered that a knowledge of Arabic had already spread throughout Persia, then Muslim.

Instead of giving sections from the Galenic sources, these will be given as they appeared in the Arabic borrowings from his work on "Simple Drugs."

[1] *Cf.* R.T. Gunther, *The Greek Herbal of Dioscorides* (New York, 1959) p. 278.

[2] Charles Singer, *Studies in the History and Method of Science* (Oxford, 1921) vol. 2, p. 63. The Constantinopolitan or Vienna Codex was prepared for the Byzantine princess Julia Anicia before 512 A.D.

[3] The Greek Text used here is from the edition by K.G. Kuehn, vol xi, pp. 379-892 and vol. xii, pp. 1-377. The Latin translation is entitled "De simplicium medicamentorum temperamentis ac facultatibus."

Oribasius (*fl.* 362 A.D.) was physician in ordinary to the Roman Emperor Julian the Apostle. He wrote a medical encyclopedia in 70 books about 390 A.D. Later he made an abstract of this work.[1] The Greek is extant but the Syriac and Arabic translations by Ḥunain ibn Isḥāq and his pupil ʿĪsā b. Yaḥyā are lost. However, Oribasius must have been well known later to writers as may be seen in quotations from them in Arabic.

Paulus of Aegina also is important for his influence on Arabic pharmacology. He is frequently quoted especially from those parts of his "Seven Books" which concerned the simples and poisons. In the last book of this compendium of medicine is the alphabetical section on simple drugs. The entire work was made available in Syriac and Arabic by Ḥunain ibn Isḥāq to physicians of the Islamic world.[2]

In the second chapter of book seven, Paulus explains the degrees of warmth, cold, dryness, and moistness. There are four for each. "First degree warmth is when an agent warms but not much so that it is barely noticeable. The same holds true for cold, dryness and moistness. When an agent obviously drys or moistens, warms or cools, then one says it is of the second degree. When something has a strong effect but not the greatest, then it is of the third degree. Finally, the utmost effect of an agent is known as the fourth degree.[3]"

Chapter three of book seven of Paulus is entitled "On the powers of the different simple drugs (according to the Greek alphabet)."

The entries in this list give a brief pharmacological decription. The sources are not mentioned but they are mainly Galenic or Dioscoridean. Oribasius also probably influenced Paulus. Some descriptions of simples follow:

"Hellebore. Both kinds are warm and dry in the third degree, are sharp, purifying, and smoothing. Therefore they are effective on skin with sores; the black [hellebore] is applied to fistulas, removes their swelling in three days.[4]"

[1] *Cf.* U.C. Bussemaker and C. Daremberg, *Œuvres d'Oribase* (Paris, 1851-1876) 6 vols.

[2] Englished by F. Adams, *The Seven Books of Paulus Aegina* (London, 1845-1847) 3 volumes; in German by I. Berendes, *Paulus' von Aegina des besten Arztes Sieben Buecher* (Leiden, 1914). See Pauly-Wissowa *Real-lexicon* u. Paulus.

[3] I. Berendes, *op. cit.*, p. 607. The "degree" as used in medicine today is similar to the usage in Paulus.

[4] *Ibid.*, p. 641.

"Calamintha is warm and dry in the third degree, also finely divisible and sharp, much stronger than peppermint. It is a kind of wild peppermint which attracts what is in the depth, and so it drives the urine and distributes the fluids throughout the body. It also mollifies periodic fever when it is strongly rubbed externally with oil and also taken orally. In sciatica, it helps in clysters and also removes particularly bad moistnesses from the skin.[1]"

"Litharge is in the midst among the metallic drugs. For this reason, it is frequently added to other remedies. It dries gently, purifies, smooths, and is astringent. It is, therefore, very effective for chafing on the thighs.[2]"

Very few descriptions of drugs are longer than these given examples. The materia medica, in the three kingdoms, are themselves not described, except for the degree of the four qualities already mentioned.

The Muslims thus had available to them in the area of simples and their pharmacological properties, the great work of Dioscorides and the lesser works on remedies by the Greek physicians who followed. The latters' accounts were either shortened descriptions from the already abbreviated Galenic books on simples and compounded remedies or abstracts from Dioscorides directly. With the Muslims, the descriptions became more and more elaborated. More and more simples were known from the vast expanse of the newly conquered world which was much greater than the Greek had ever been. The new Arabic pharmacology was reborn with a deep interest and enthusiasm.

One of the oldest scientific works in modern Persian is the pharmacological treatise by Abū Manṣūr Muwaffaq b. ʿAlī al-Harawī (fl. 970) of Herāt, Persia. In Arabic, it is called *Kitāb al-abniya ʿan ḥaqā'iq al-adwiya*, "Book of the foundations of the true [properties] of remedies.[3]"

[1] *Ibid.*, p. 654.

[2] *Ibid.*, p. 677.

[3] The original text was published by F.R. Seligmann (Wien, 1838). The same author published a Latin translation (Wien, 1831-1833). A German translation more readily available was published by Abdul-Chalig Achundow, "Die pharmakologischen Grundsätze des Abu Mansur Muwaffak bin Abi Harawi" in *Historische Studien aus dem Pharmakologischen Institute der K. Univ. Dorpat* (Halle, 1893) vol. III, pp. 139-414.

The introduction by abū Manṣūr is of interest in showing the Indian influence[1]:

"According to Indian physicians, everything is divided into four categories. The first class is composed of food, the second food as well as medicinals, the third medicaments only. Those which belong to the fourth class are poisons. Everything which has an effect upon the human body is likewise of four types. One is that which affects the interior and also the exterior; for example, wheat is a food inside and on the exterior serves as a sprinkling powder on a wound. Another type has a curative effect in the stomach but is painful outside; for example, garlic increases the inner bodily warmth but on the exterior it is poisonous. A third type is poisonous when taken internally; externally it is like theriac as lithargyrum, aerugo aeris, and similar ones. The last type has the same poisonous effect internally and externally as aconite and ergot. There is nothing in the world, as the Greeks and Romans falsely stated, that one may use as a food or medicine whose value finally may become that of the fourth category for then the series is at an end. If what these latter (*i.e.* the Greeks and Romans) say is correct, then a fifth category would have to exist in order to minimize the harm caused by that of the fourth. Everything, consequently, which comes at the end of the fourth category, is lethal to humans immediately when they eat it or use it as a medicament for there is no antidote for it.

"However, everything one has is compounded of four fundamental properties, hot, cold, moist, and dry. Since the moist and the dry arise from the cold and hot, it is impossible that a remedy or foodstuff be hot in the first degree and dry in the second degree, as the Romans declared. The latter are here in error. For the Indians in this connection are correct. Therefore I follow their footsteps. Further, since the Indians possess more drugs and since these are better and more effective, therefore, the possibility of elaborating the science by them is much greater.

"Moreover, there is everything which one finds of drugs and foods in the remaining six parts of the world except for three things. For these, there are, however, better and more effective substitutes, namely, 1. *Terra sigillata* for which there is *Terra kengica*, 2. *Ol. Amyris gileadensis* whose substitute is *Ol. Pandani odoratissimi [rūghan-i-kāzī]*, and 3. *Paeonia* whose substitute is *Lapis Benaresicus [sang-i-Benaresī]*. This stone is better than the *Paeonia* since the one year old *Paeonia* is too weak and ineffective; this stone, however, always remains effective. The remaining drugs which are extant in India are not to be found in other parts of the world."

[1] A. Achundow, *op. cit.*, pp. 139-140.

A good example from this text is on the hazelnut, *bunduq*. "Galen says that the hazelnut provides more nourishment than the walnut, is colder than the earth, and pulls together better. The hazelnut without the skin is easy to digest when eaten and causes flatulence. The skin on it is astringent, pulls the body together but is harmful to the stomach. The Indian opinion is that the hazelnut causes more flatulence and is harder to digest than the walnut and possesses some cold. When it is taken with figs, dates, or honey, then it is good for scorpion stings. The Romans call it *avellana*. It is hot in the first degree and moderately moist and dry, somewhat hard to digest, causes vomiting and headache. With figs, honey, and garden rue, hazelnut is effective against poison. Rathā[1] says that it is moderately warm, cold, moist and dry, with slight disposition toward warmth. It shows yellow gall and, in all effects, it is close to that of the walnut.[2]"

"Another drug of the simple oils, is *duhn al-jauz*, walnut oil. It is hot and moist, useful for the stomach and kidneys, especially for the well-fed. The oil of the peels does away with chronic itching and sores and ameliorates rawness of the skin." Similarly, *duhn al-simsim*, oil of sesame, is useful for coughing, softens rawness of the throat, weakens the stomach and is an antidote.

"*Duhn al-lauz*, sweet almond oil, is good to open [the bowels], and is for the stomach, kidneys, liver, chest, and lungs. It is hot and moist to the end of the first degree.[3]"

Abū Manṣūr is to a large extent responsible for having brought Indian pharmacology to the serious attention of the writers in Arabic. In his time, many physicians were Persians and so his work spread to the Near Eastern scientific workers.[4] Indians and early Persians

[1] A. Achundow, *op. cit.*, p. 307. According to Jolly, the Indian *Rathā* is a name for collections of fairy tales, for example.

[2] A. Achundow, *op. cit.*, pp. 157-158.

[3] A. Achundow, *op. cit.*, p. 198. *Duhn* is an oily preparation.

[4] *Cf.*, *Ibid.*, pp. 306-307.

are cited in this work. The first important scientific writer in Arabic medicine was al-Rāzī (d. 923) who came from Khurasan and was personal physician to Caliph al-Muqtadīr (908-923) in Baghdad; he is cited by abū Manṣūr twelve times. It is of interest that abū Manṣūr does not mention his contemporary, ibn Sarābiyūn,[1] nor did he know al-Majūsī (d. 944) and his famous work *Kāmil al-ṣinā'a al-ṭibbīya* or *Kunnāsh al-malakī*.[2]

In the twenty-seventh and twenty-eighth treatises of his famous book, *Kitāb al-taṣrīf liman 'ajiza 'an it-ta'ālīf*, a compendium of medicine, al-Zahrāwī discusses remedies and their compounding. Other treatises in this text contain many interesting sections on the knowledge of medicines in Spain in this period. For example, the subject of medicinal oils is fully treated in the twenty-fifth treatise.[3]

For olive oil, al-Zahrāwī gives :

"*Al-zait*. Its strength is variable as is its nature, its usefulness, or its harmfulness in many directions. This is possible since it may be new, old, or in between these extremes. Further, it may be from salted olives which had been concealed and then spoiled in an underground vault. Then some may be extracted with potable water, some of it from olive which has been dried in the sun until its juice came out and it is stored, some extracted with the press without using water, and some extracted by using a fire. The oil also varies according to the locations and soils, thus bringing about differences in its strength, nature, usefulness, and harmfulness. As to the oil which is extracted from green, unripe olives, the Greeks call it *infāq* oil.[4] Dioscorides asserted that *infāq* oil is Greek; we call this 'oil of the water'."

One of the more interesting and valuable treatises is the drug book of ibn Samajūn (d. 1001) of Cordova; it is entitled *Al-jāmi'l'aqwāl al-qudamā' wa'l-mutahaddathīn min al-aṭibb' wa'l-mutafalsifīn fī al-adwiya al-mufrada*, "Collection of statements of older and recent

[1] *Cf.* Brockelmann G, I, 233. He wrote a *Kunnāsh*, a medical compendium, in Syriac in larger and smaller editions. *Cf.* MS Aya Sofya 3724.

[2] MS Jarullah 1077, 1078. He was called Haly Abbas in Latin and his book was called *Liber regius* in Latin.

[3] *Cf.* S.K. Hamarneh and G. Sonnedecker, *op. cit.*, pp. 77-126. The Arabic text is given on pp. 81-97. The translation given is based on this text.

[4] From Greek *omphákion*. Dioscorides has it in his materia medica. *Cf.* C. Dubler, *op. cit.*, vol. 2, pp. 35-37.

physicians and philosophers on simple remedies.[1]" The remedies are arranged in the usual order of the Arabic alphabet as in ibn al-Baiṭār later on.

The book on simples of ibn Samajūn of Cordova is composed of citations which are excerpts from the most recognized authorities of his day and before him, both Greek and early Arabic. As a main source, ibn Samajūn found Dioscorides' "Materia Medica" to be most important.[2]

The late Professor Paul Kahle [3] gave an example of an entry in ibn Samajūn's excellent work. The latter's treatise is of importance since it was well known to the later ibn al-Baiṭār who reached the peak of this type of treatise in his *Kitāb al-jami' fī al-adwiya al-mufrada*.

Part of the section on the mandrake, as given by ibn Samajūn, follows :[4]

"Aḥmad b. Dāwud [Abū Ḥanīfa al-Dinawarī (820-895)] said : The mandrake is the root of *al-maghd* which is the wild *luffāḥ*. Another time he said : *al-luffāḥ* is somewhat yellow like the eggplant. It is counted among the odoriferous plants since it is of pleasant smell. In Persian, it is called *al-shābīzak* which is the small apple. It belongs to the materia medica, especially its root. Physicians call it *al-maghd* and also *al-yabrūḥ*. I consider that as Arabic of the language of the peninsular Arabs. Dioscorides said : *Al-yabrūḥ* is of two types. One of them is male and the other female. The male has white. smooth, large, wide leaves, similar in color to the beet leaf. Its *luffāḥ* [fruit] is double [the size of] the *luffāḥ* of the female and its color is similar to the color of saffron, pleasant in odor with a heaviness...

"Isḥāq b. Sulaimān [al-Isrā'īlī (832-932 ?)] said : The plant of the mandrake is a plant which covers the earth for it has no stalk for it to rise. It is of two types, male and female. The male is referred to as male since its root is a single one, white inside and out. Its leaves are wide, smooth, similar to beet leaves in their width and softness. Its *luffāḥ* is larger, doubling the size of the female *luffāḥ*. Its color is

[1] The ibn Samajūn MS is in the Bodleian Library, Bruce 47 and 48.

[2] *Cf.* M. Meyerhof, *Quellen u. Studien zur Geschichte der Naturw. und der Medizin*, vol. III.

[3] "Ibn Samajūn und sein Drogenbuch," by Paul Kahle in *Documenta Islamica Inedita* (Berlin, 1952) pp. 25-44.

[4] From the only edited Arabic section on mandrake by P. Kahle, *op. cit.*, pp. 33-7.

like saffron. Its odor is good but its taste is bad, disagreeable, and unpleasant...

"Galen said : *Al-yabrūḥ* is the root of *al-luffāḥ*. Al-Masīḥ b. al-Ḥakam,[1] Muḥammad b. Zakarīyā,[2] Isḥāq b. Sulaimān, Aḥmad b. Ibrāhīm [3] and Muḥammad b. 'Abdūn [4] state the same. In the book *Al-Mayāmir*, [Galen] said : *Al-yabrūḥ* is *al-la'ba*. Ḥunain b. Isḥāq said, in [his] "Book of Simples" that he wrote in question and answer form, *al-yabrūḥ* is the root of wild *luffāḥ*. Ahron b. 'Ayan said *al-shābīzak* is the rind of the root of *al-luffāḥ*. Al-Masīḥ b. al-Ḥakam said the same. Isḥāq ibn 'Imrān said *al-yabrūḥ* is *al-shābīzak* which is *al-arjbalīṭa*. Aḥmad b. abū Khālīd, 'Imrān b. Abī 'Umar, Yaḥyā b. Isḥāq [ibn Sarābiyūn] and Muḥammad b. 'Abdūn stated the same. Aḥmad [ibn al-Waḥshīya] wrote in his *Book on Poisons al-yabrūḥ* is *al-luffāḥ*..."

There then follow lengthy quotations by Galen, Oribasius, Paulus Aegina, Māsarjawaih, Ḥunain b. Isḥāq, al-Dimashqī, Issac Israeli, 'Isā b. Māsa, Muḥammad b. al-Ḥasan, Dioscorides, ibn Māsawaih, al-Ṭabarī (838-923), and al-Rāzī (865-925).

Ibn Samajūn's account of mandrake begins with a description of its appearance and the value of its morphological structures, and then goes on to the various words used in connection with the mandrake, the degrees of its qualities, *i.e.* cold, warmth, moistness, and dryness, its pharmacological properties as a simple and in compound remedies for various ailments, and finally its use in a prescription as an antidote. This elaborate method of description of simples in alphabetical order became the archtype for ibn al-Baiṭār centuries later when he wrote the most comprehensive work in this form on the subject.

It is significant that Dioscorides is the author most often referred to and also the most quoted at length. Galen and Isaac Israeli are those quoted next in frequency.

In the *Kāmil al-ṣinā'a al-ṭibbīya* of 'Alī b. al-'Abbās al-Majūsī (d. 994),[5] the pharmacological properties of the simple drugs are

[1] Al-Dimashqī, Brockelmann, S. II, 1029.

[2] Al-Rāzī.

[3] Ibn al-Jazzār (Gal GI 238) flourished in Qairawān and died in 1009 when he was over eighty years of age. His most popular work was *Zād al-musafīr*, Provision of the Traveler." He was a pupil of Isḥāq al-Isrā'ilī.

[4] A work by this author on materia medica is unknown.

[5] Vol. 2, *maqāla* 2.

described in fifty-seven chapters. Among the latter are included those on botanical simples, animal simples, mineral simples, medicinal oils, taste and odors of simples, odor, strength, constipating and opening qualities, deterioration, pain decreasing ability, cicatrization effects, diuretic effectiveness, sudorific qualities, strength of seeds, leaves, and roots, extracts, gums and humors of drugs. Also stones, salts, galls, dungs, diarrheic simples, and dosage are explained in separate chapters. The descriptions are not given in alphabetical order nor are they always on simples. Frequently, prescriptions for a compound remedy are given so that the treatise does not effect a rigid separation between simples and compounded drugs.[1] The compounded drugs are also described in a separate section but the entire book is full of interesting prescriptions, giving a very complete account of the medicine of the day in a well organized fashion.

An alphabetical list of materia medica is given by ibn Sīnā in his *Qānūn*,[2] book 2, *māqāla* 2. The list is made up according to the initial letter but the following letters are not alphabetized. Unlike al-Majūsī and others where the descriptions are fairly long, ibn Sīnā usually has a short account on each simple of about three to five lines. Some well known ones are larger.

"Glass has a nature warm in the first [degree] and dry in the second, brightens the teeth, is good for the hair if it is smeared on with oil of jasmine. Its activity and properties are constricting, and gentle for head ailment. Used for washing, it is a brightener for teeth and eyes. They come out white. Rubbing with it is strengthening and very useful. Used with syrup it is good for the kidneys and bladder.[3]"

The work of ibn Sīnā is secondhand. Earlier works, ibn Samajūn as an example, are much fuller and much more complete in regard to the number of simples mentioned as well as their pharmacological properties. Ibn Sīnā's section on the simple drugs was quoted frequently by al-Ghāfiqī because the former laid stress on the therapeutic properties of drugs as the former gave them.

Aḥmad al-Ghāfiqī's (d. 1164, according to Wuestenfeld) *Kitāb al-*

[1] The text used here is the printed edition of Bulaq, 1294 H., pp. 84-152 for the simples. It was printed in Venice and Lyons, 1523, under the title of *Liber regius* in Latin.

[2] The text used here is the printed edition of 1295 H. *Cf.* pp. 154-247.

[3] *Ibid.*, p. 185.

adwiya al-mufrada, "Book on Simple Drugs," is known only in part. The latter half of it is still missing. However, much of it is preserved in more than two hundred quotations by ibn al-Baiṭār in his famous book to be described later. An abridgement of al-Ghāfiqī's work was made by Bar Hebraeus (1226-1286). Many copies of the latter work are available. Part of it was translated with a commentary into English.[1]

From the unabridged copy of the first half of al-Ghāfiqī's work,[2] it is obvious that this text is probably one of the finest of the Arabic period. There is no doubt that ibn al-Baiṭār obtained most of his material for his work from al-Ghāfiqī who, in turn, copied from the excellent work of the much earlier ibn Samajūn, who must now be recognized as one of the greatest botanists and pharmacologists of the entire Arabic period far outstripping ibn al-Baiṭār and al-Ghāfiqī in his wide learning.

Examples from al-Ghāfiqī will indicate his contribution to the Arabic materia medica.

"*Basbāyij*, polypody.[3] It grows on moss-grown rocks and on the trunks of old oak trees and on the tree moss *[ushna]*. It is about a span high and resembles the plant called *ptéris*, the male fern *[al-sarakhs]*. On it is some down which is long but not as fine as that of *ptéris*. The root has branches like the fish called polyp *[kathīr al-arjul]*. It is as thick as a little finger. If rubbed, the color of its interior appears to be green. Its flavor is astringent and inclined to sweetness; this is the best.[4] It is desiccative without pungency.

Dioscorides : It is given cooked with fowl, fish, white-beetroot or Jew's mallow. It purges black bile and phlegm without provoking colic or causing any harm.

Ibn Māsawaih : It is also cooked with barley water. The dose given is from one to five dirhams, boiled or strained.

Al-Majūsī : Or finely pounded with sugar.

[1] M. Meyerhof and G.P. Sobhy, *The Abridged Version of "The Book of Simple Drugs,"* fasc. 2 (Cairo, 1937) pp. 353-354.

[2] This text was studied in the Dār al-Kutub al-Miṣriyya, the National Library in Cairo.

[3] Compare with *Traité des simples par ibn el-Beithar* traduit par L. Leclerc, in *Notices et Extraits des Manuscrits de la Bibliothèque Nationale 23, 25, 26*, 3 vols. (Paris, 1877-83) no. 280. Abbreviation is Leclerc, al-Baiṭār. *Cf.* Dioscorides, IV, p. 186.

[4] Galen, VIII, xii, 107.

Ibn Sarābiyūn : Or with barley water. It purges the tenacious chyme from the stomach and the articulations, but causes nausea.[1]"

In ibn al-Baiṭār, the article on this drug is much longer than in al-Ghāfiqī mainly because of further quotations from old Arabic and Persian authors.

Another quotation from al-Ghāfiqī will suffice to yield an overall picture of his work.

"*Bauraq*. Soda, natron (sodium carbonate), Ibn Isḥāq : There are many kinds of *bauraq;* one of them is the Armenian which is imported from Armenia, and the so-called natron which is brought from the oases. The latter is of two types, a red and a white one, and it resembles rocksalt *(milḥ ma'danī);* its flavor is intermediate between acidity and salinity.

Ibn Wāfid[2] : There are many kinds of *bauraq* and its native places are numerous. There is a kind which is liquid and afterwards hardens, and another kind which is calcareous from the beginning. Some of it is red, some white, gray, or multicolored. Natron, though belonging to the class of *bauraq*, has different active properties from *bauraq*.

Al-Rāzī : Its kinds are many; among them the goldsmith's natron *[bauraq al-sāgha]* which is the white and earthy, and the 'frothy' *[al-zabadī]* which is the best of them and whose color is earthy gray. Another kind is the 'natron of willow' *[bauraq al-gharab]* which is found in the willow tree.

Dioscorides[3] : *Nítron* [in Greek]. The choicest is the light and rose-colored or that which is white and porous like a sponge. That which is called *aphrónitron* [in Greek], meaning 'foam of *nítron*', is, so it is said, the Armenian. Its choicest kind is the laminated which is easily crushed, purple-colored, resembling froth and of pungent taste, like that which is brought from the town of Philadelphia. The second in quality is the Egyptian; it also exists in the district of Magnesia in the land of Caria [Asia Minor]. Galen[4] : The difference between the white African nitre which is known as the 'frothy' and the foam of nitre *[aphrónitron*, Greek] is that the latter is dry and looks like white

[1] M. Meyerhof, and G.P. Sobhy *op. cit.*, p. 353.

[2] (998-1074). He wrote a *Materia Medica* extant in Latin as *De Medicamentis simplicibus*.

[3] Dioscorides, V, p. 113. *Bauraq* was frequently a borax.

[4] Galen, IX, xii, p. 212.

wheat-flour and is not like the powdered stone, which is brought from Assos,[1] and which is ash-colored. The frothy nitre is not sifted like flour but is solid and compact. It is this kind which people use every day to wash their bodies in the bath. Its property not only cleanses but also dissolves purulent humors causing itch. If it did not cause nausea, provoke vomiting, it would be most successful in liquifying viscous humors, and would cure one from the absorption of poisonous mushrooms. Another author [ibn Wāfid] : The nitre is of two kinds, natural and prepared. The natural is the mineral one. The latter is also of two kinds, Armenian and Egyptian. The Armenian is the better, but we never see it here. The Egyptian is of two kinds : one is called natron and is a stony salt of reddish color and saline flavor with some bitterness which proves its burning quality; the other is called bread nitre *[bauraq al-khubz]* since the bakers of Cairo dissolve it in water and paint the bread's surface with it before baking in order to make it shiny. Of a lower quality is the prepared nitre which is called by us [in Spain] natron. It is a calcareous salt in shining pieces from which glass is made with lead solution *[rutūbat al-raṣāṣ]* and alkali *[gilī]*. Glass makers mix them together and put them in the fire. It is also called *tinkār*.[2]"

Ibn Hubal (1117-1213) has a list of simples, not in alphabetical order but quite lengthy, in his *Kitāb al-mukhtārāt fī al-ṭibb*, selection on medicine.[3] The descriptions for the simples are about as abbreviated as those in ibn Sīnā's *Qānūn*, and in the same way, are almost entirely of pharmacological interest.

"Licorice : Its best is the fresh. The nature of it is warm and, some say, cold, There is no doubt that it possesses warmth and its root has this property. Its root is moist and its juice is good for cataract, lightens blocking of the lungs, is good for swellings of the neck and the throat, and clears the voice. It is good for cough, eases intense thirst and stomach disorder. It is useful for kidney and bladder ailments and their ulcers. It eases burning of the urine and is useful for chronic fevers. Its root and its juice are for foot ulcers and wounds.[4]"

[1] A town in Northwest Asia Minor.
[2] M. Meyerhof, *al-Ghāfiqī*, pp. 372-4.
[3] In the text published in Hyderabad, 1364 H., vol. II., pp. 1-207.
[4] *Ibid.*, p. 138.

The assimilation of Greek science by the Arabs was not accomplished in Spain until the tenth century. Letters and arts took on a parallel development.

According to Leclerc,[1] Spanish Muslim civilization is distinguished from the oriental by the cultivation of the natural sciences and botany by people specializing in these areas. This was not true in the Near East where many scholars were physicians who had secondary interests. Further, in Spain, botany was studied more in nature than in books not only for medicine but for agriculture and the other practical arts.

Ibn Juljul (fl. 976-1009) [2] published a book on the interpretation of names of plants mentioned by Dioscorides and another on simples unknown to the Greek botanist. Then there was the Encyclopedia (Books 27-28) of al-Zahrāwī's *Kitāb al-taṣrīf*. According to Leclerc,[3] in the eleventh century, there were three great authorities on botany. There was besides ibn Juljul, ibn Wāfid, of the next generation, who wrote a book, *Kitāb al-adwiya al-mufrada*, on simples in over 500 pages. Then there was al-Bakrī (b. 1040-d. 1094), the geographer, who described plants and trees. His main works are *Mu'jam ma'sta'jama* and *Al-masālik wa'l-mamālik*, respectively "The [geographic] dictionary of the insignificant," and "The routes and the realms."

In the twelfth century the two most important works in this field were a treatise on simples by al-Ghāfiqī, and ibn al-'Awwām's work on agriculture, *Kitāb al-falāḥa*. Al-Idrīsī, the great traveller and compiler, called Sharīf, contributed much work to this field.

The thirteenth century was for the natural sciences what the twelfth was for the medical and philosophical sciences in Spain. There was abū al-'Abbās al-Nabātī from whose work ibn al-Baiṭār made many citations. He was also the latter's master. Born in 1197, ibn al-Baiṭār migrated to the Maghrib, then made his way to Tunis and Cairo, finally dying in Damascus in 1248.

In the preface, ibn al-Baiṭār set for himself six goals in the writing of the *Jāmi' al-mufradāt*.

1. To describe the simples and foods in use by Dioscorides and Galen, and their results as well as his own in research.

[1] Leclerc, al-Baiṭār, vol. I, p. ii.
[2] Wrote *Kitāb al-ḥashā'ish*.
[3] Leclerc, al-Baiṭār, vol. I, p. iv.

2. To detail with fidelity the truth of ancient botany, resolving many contradictions.

3. To avoid repetition and write with clarity.

4. To use the alphabetical order to make the book more useful.

5. To note each remedy and its usage by the ancients and moderns and their actual experience.

6. To give synonyms (mainly in Berber, Latin, Greek) in diverse languages, the localities where they are found, pronunciation of the names by giving vowels and diacritical marks and corrections of errors.[1]

An example from ibn al-Baiṭār reads :

"357. *Bunduq [Corylus Avellana* L., hazelnut].

"Abū Ḥanīfa : *Bunduq* is none other than *jillauz. Bunduq* is Persian and *jillauz* is Arabic. Galen Book VII, Dioscorides I, Hippocrats, Ibn Māsawaih : The hazelnut is more compact and less moist than the nut; it is more nourishing if it is digested, because of its density. It is less oily than the nut and more rich nutritionally. It is slightly acidic. It remains in the stomach for a long time. It creates bile. It gathers in the jejunum, fortifies it, and helps it when it is affected. It has a special power in that when it is eaten ahead of time it is good against poisons; it is also good for this purpose afterward when taken with rue and figs. It intoxicates. Al-Masiḥi : It breaks down the viscous humors. It is good for expectoration which comes from the chest and from the lung. Al-Ṭabarī : Taken with a fig and some rue, it is useful against the bite of the scorpion. In my youth, living around Mosul, I saw people of the country bring the hazelnuts in their arms and affirm that they found them effective for scorpion bites. Avicenna : It touches off a little heat and dryness. It provokes vomiting. Al-Isrā'īlī :[2] It provokes more flatulence and borborygmi than the nut.[3] It inflates one more with wind, especially if it is ingested with its internal covering. Yet, this covering is strongly astringent and holds the wind; if it is removed, the hazelnut passes more easily and is digested better. Al-Rāzī, in his "Treatise on the Correctives of Foods" : It passes slowly and nourishes much. One corrects it especially with

[1] Leclerc, al-Baiṭār, vol. I, pp. 273-4; for the Arabic, *cf.* the al-Muthanna Library edition (Baghdad, n.d., 1968 ?) in 4 vols.

[2] Probably Isaac Isreaeli.

[3] Probably *al-jauz al-ma'kūl.*

sugar. If one has made bad use of it to the point of distending the stomach, then it is necessary for one with a cold temperament to drink after it some honeyed water, and with hot temperament, a julep. If this is insufficient, it is necessary to take a prepared laxative. It is essential that one eat it without its covering."

Another example : *māsh [Phaseolus mungo* L., Mungo bean] :

"This word is written with a *shīn.* Sulaimān ibn Hassān [ibn Juljul] : Some physicians confound *māsh* with *jullābān* which is in error. It is a small grain, the size of the large ervum, green, brilliant, having an eye like the pea. One cultivates it as food in the Maghrib. It is originally from Yemen where it is called *aqṭin.* It is a food with a good nature. Galen, in his "Book on Nutrition" : It is, in sum, a substance which resembles the bean but which differs from it in that it is less swollen. It is not more detersive; also it remains a longer time than the bean in the stomach and intestines. Ibn Māsawaih : The *māsh* is cold in the first degree. It is between moistness and dryness but closer to the latter, especially if one removes its covering, then brings it to a boil and adds garum and oil of bitter almonds. Its envelope has a certain acidity. It furnishes juice of a good quality and will not cause swelling. It is very salutary when applied in a cataplasm on weak organs, and it calms suffering especially if one rubs it with its decoction and saffron. It is better in summer for hot temperaments and inflammatory ailments. To make it effective for swelling and to make it laxative, one must boil it with carthamus and with oil of bitter almonds. If there is no elevated fever, one adds to it some purslane, some lettuce, some orache, and some threshed barley. If one wishes to make it a constipator, one grills it with its envelope, then boils it with water, decants, then boils again with patience, and finally adds juice of pomegranates, sumac, and omphacine oil. Thus prepared, it inhibits the wind and calms inflammation. If this oil is not available, then one must use oil of bitter almonds. Sindeshār : It calms the effervescence of the bile and depresses sexual appetite. Māsarjawaih : It resembles the lentil but it is less cold. Al-Rāzī in his "Treatise of Correctives of Food" : If one gives it to those with hot temperaments, to those who have need of a light regimen, there is no need of a corrective and it does not cause inconvenience. One should give it to them, for it refreshes and nourishes moderately. But for cold temperaments, and those who have flatulence, one corrects it by administration of electua-

ries with cumin and in giving mustard with it. Another : The juice diminishes the wind. It is prepared like sorbet; it is good for catarrh. It is salutary for hot temperament and in subjects affected by cough. Boiled in vinegar it is good for ulcerated scabies.[1]"

Altogether there are 2,324 paragraphs and 3,000 terms in alphabetical order. This *Jāmiʿ al-mufradāt*, "Collection of Simples" treats of food and drugs. There are original remarks by the author throughout although most of it is a methodical compilation. More than 150 authors are cited. Most are from Dioscorides and Galen. Then al-Rāzī is cited about 400 times, ibn Sīnā 300 times, al-Ghāfiqī 200 times, al-Idrīsī (called Sharīf) 200 times, ibn Bājja (Avempace), Isḥāq ibn Amrān, ibn Māsawaih 160 times, ibn Māssa and abū Ḥanifā 130 times, Masīḥ ibn Ḥakīm, abū al-ʿAbbās al-Nabātī 100 times. There are also many citations of Indian origin.

In each case, the description is given first, then therapeutics, and the synonyms are given when known. As to the sources of ibn al-Baiṭār, his primary one was al-Ghāfiqī, already described. Before the latter, ibn Samajūn also of Spain deserves the credit for this valuable literary form in alphabetized order and the kind of description of simples in general. Since the works of ibn Samajūn and al-Ghāfiqī have been brought to light, ibn al-Baiṭār is no longer considered as the greatest writer on pharmacology and botany in Arabic. As yet, there has not appeared any extensive study of ibn Samajūn but this may, in the future, give a clearer idea of the actual origins of Muslim pharmacological and botanical studies.

With al-Ghāfiqī came the high point of discussion in Arabic lists of simples. Following him, the decline began with ibn Hubal and ibn al-Baiṭar both already mentioned. In this same category should perhaps be included ibn Rasūl who lived toward the end of the thirteenth century.

Ibn Rasūl al-Ghasānī is the author of *Al-muʿtamad fī al-adwiya al-mufrada*. "The trustworthy on simple drugs." This is a very extensive work based party on that of ibn al-Baiṭār. It is alphabetized and pointed toward pharmacological data in its contents.[2] According to ibn Rasūl this is a description of verdigris and its properties :

[1] Leclerc, al-Baiṭār, vol. III, (1883) pp. 269-70.

[2] The printed Arabic text appeared in Cairo, 1951, second edition, corrected and indexed by Professor Mustafā al-Saqā.

"Of the manufactured verdigris, there is the 'mineral'. The strength of verdigris in warmth and coldness is of the fourth degree. Its best is that which comes from the mine, then comes the one manufactured except that the latter is stronger in burning, constipating, dissolving, removing flesh and corroding and emaciating. It burns ulcers. If it is mixed with a little of the *qīrūṭī* [1] compound preparation, it becomes a polishing drug without harm. The strengths of the different kinds are similar in strength to that of burned copper. It is constipating when warmed. It removes specks in the eyes which thwart the healing of ulcers. It is gentle or draws tears. It lessens the spreading of gathering ulcers and [lessens] swelling of wounds. If it is mixed with sesame oil and wax, it heals gathering ulcers. If it is cooked with honey, it purifies dirty ulcers, and hard hemorrhoids. If it is mixed with honey and used as a collyrium, it dissolves the induration of the eyelids. If it is kneaded with honey or cooked with it, it is useful for ulcers of the dry muscles, all of [the eye] as for the ulcers of the mouth and its pustules, and loosening of the gums, and ulcers of the nose and ears..." [2]

[1] *Cf.* Thābit ibn Qurra's *The Book of al-Dhakhīra*, ed. by G. Sobhy (Cairo, 1928 pp. 96, 124, 125. (In Arabic, it is *Kitāb al-dhakhīra fī ʿilm al-ṭibb*). The authorship is at present in doubt.

[2] Ibn Rasūl, *op. cit.*, pp. 208-209.

CHAPTER SEVEN

DRUGS IN MEDICAL BOOKS AND WORKS ON MEDICAL SPECIALTIES

That the art and science of medicine was among the most cultivated areas developed by the early Muslims is not surprising. In the course of the two centuries after Muḥammad, the Arabs, by conquering most of the ancient world, had gone from a relatively isolated and healthy Bedouin existence to one which was urban with all its attendant ills. By observing the greater sophistication, especially of the Greeks, Persians, and Indians in medicine, it served to help encourage the Arab rulers not only to become interested in this vital field but to encourage its growth in knowledge and in making foreign language works accessible to Arabic readers by translations.

Related medical sciences, in this period, grew just as rapidly. Zoology, alchemy, botany, chemistry, and pharmacology were elaborated in this same renascence. It was pharmacology, however, which experienced the most amazing change both qualitatively such as the more careful choice of materia medica in therapeutics [1] and quantitatively in the increasing number of simples both from natural sources and from chemically manufacured ingredients.

This account will not begin with Galen's medical works since these would properly belong to a period when the Hellenistic world was still distant from the rise of Islam. This reason taken together with the fact that much of Galen was later taken over, sometimes word for word, makes direct quotation of the famous Galen unnecessary. Galen's pharmacology further deserves a completely separate study. This present book presents, however, a necessarily brief account of the influence of antiquity's greatest physician on the works of those who followed him.

Aëtius of Amida (fl. 550) is a case in point. He was physician to the Byzantine court and author of a medical encyclopedia comprising sixteen books based chiefly upon Galen and Archigenes. The encyclopedia is called *Tetrabiblon* since, in some manuscripts, the text is in four parts. Although the Greek text has not been completely edited, the Latin translation has been carried out.[1]

[1] *Cf.* al-Samarqandī, Introduction, explaining the manner of choice of the simples and compound remedies.

It is an extensive work but its most valuable section is its seventh book on ophthalmology, and its Greek has been edited.[2]

A section taken largely from Galen is the following :

"Chapter forty. Drugs for the thinning of scars and leucoma. Moderate purifying remedies are used on those scars where a lighter color is possible. The strongest cleansing agent is burnt copper ore. When these agents are washed, then they acquire a cleansing effect but in a more mild manner than they have the power to erode. It is better to use less acidic means. Stronger than the above mentioned are vitriol ore and verdigris so that they also may be added in treating granulation of the eyelids and the resulting horny appearance.

"Some physicians employ gall-apple which is a very strong astringent. Stronger yet in use is copper sulfate in tanning and acidity. The latter is much milder after burning and washing. Further, hammered steel has the same attributes. All these astringent medica which possess an earthy quality, have the attribute to make the rawness of granulation and their crumbling and horniness disappear; here belong vitriol ore, verdigris, and similar ones.

"All materials which belong to the class of plant juices, as the juices of unripe grapes, hypocistus, greater cleandine, and acacia, when applied to the eyes are washed off too easily by tears. A cleansing effect without biting is possessed by deer and goat horns. Incense possesses only a minimal cleansing power; it is pain killing and mature. The horns of the mentioned animals are cleansing but they are neither pain killing nor have a ripening effect for they have a cold and dry nature. The bark of incense tree is very astringent but is less effective than those named. But the small pieces of the incense which used to be called manna are different from the pure incense in that it exerts a lightly astringent effect. In the above, no small pieces of bark were admixed. A cleansing effect is possessed also by the copper carbonate used by the painter, and indigo, and so may be employed safely on inflammation-free sores.

[1] By Janus Cornarius (Basle, 1542).

[2] By J. Hirschberg, ed. and translated into German, *Die Augenheilkunde des Aëtius aus Amida* (Leipzig, 1899).

"A mixed effect is brought about by aloe, as by the rose, for it possesses a bitterness whose nature is to cleanse. It also, however, possesses an astringent which cleanses and cicatrizes sores. But ammonium chloride and calcium carbonate belong to the strongest agents so that they also are suitable for eyelid sores.. Of the aromatic agents, there are cassia, betel and amomum which possess a disintegrating effect but little of astringency. In general, the cleansing media should be known which yield moderate results and which do away with crumbling and horniness. All of the latter are also for thick scars.[1]"

Another Greek, Paulus of Aegina, should be of interest as a well-known author who influenced the Arabic writers but who, himself, owed much to Galen and Oribasius. His medical encyclopedia was translated by Ḥunain ibn Isḥāq into Arabic in the ninth century. Thus, he was well known in Islam.[2]

For scrofula, Paulus' remedies read :

"Myrrh	10 dirhams
Ammonium chloride fumes	2 dirhams
Oak mucilage	8 dirhams
Galbanum	4 dirhams
Wax	1 dirham

"It is all pulverized together in a mortar.

"For swollen and hardened glands of the breast.

Bird dung	1 pound
Dry resin	1 pound
Wax	1 pound
Galbanum	3 ounces

"A remedy for scrofula.

Old oil	2 pounds
Wax	1 pound
Colophony	4 ounces
Natron	4 ounces
Onions	12 dirhams

[1] J. Hirschberg, *op. cit.*, pp. 93-97.

[2] The Greek text of J. Cornarius was published by Henri Estienne in his *Medicae artis principes* (Paris, 1567). J.L. Heiberg published it in the *Corpus medicorum Graecorum* (Leipzig, 1921, 1924).

"Remove the outside of the onions and put the rest in oil for three days, then cook until it is roasted, then throw away the onion. Melt the wax and colophony in the oil and after its removal from the fire, add the finely pulverized natron. It opens abscesses. Or, use ashes of figs 2 ounces, alum 1 ounce, foam of natron 1 ounce, and tar 7 ounces.[1]"

In the Muslim period, the plan of Paulus' book was generally followed in medical books. In a medical encyclopedia, as translated by Ḥunain ibn Isḥāq, Book I contains hygienic conditions and rules to be followed, discussions of temperaments and humors, and the power of nutrients, all in separate chapters. The next book elaborates on the subject of fevers and their accidents. Then follow chapters on the ailments including symptomatology, diagnosis, and therapy giving prescriptions using materia medica as well as physical treatment. Book III begins with the skull and goes to the feet and nails. Book IV is concerned with other ailments, their symptoms and therapy. Poisons and antidotes are concerned with flesh wounds, fractures, and surgery. The last book discusses the simples as already described and the compound remedies. It is thus seen that running through the entire text are diverse facts on pharmacology in treatment, and in regard to physiological properties and reactions.

Another text on the eyes is diffused with many prescriptions of pharmacological interest. This treatise is the tenth "in which are recorded the compound remedies mentioned in the ninth treatise as they were composed by the ancients for the diseases occurring in the eyes,[2]" and is by Ḥunain ibn Isḥāq. The prescriptions of this section are credited to such sources as Galen, Oribasius, Aetius, Paulus, and Alexander of Tralles. The last was a Byzantine physician who settled in Rome. One of his medical works was on ophthalmology.[3]

Prescriptions from Ḥunain follow :

"Recipe for a useful eye salve which soothes the pain from the very first day, with the epithet, dog's excrement; it repels the swelling from the very first hour. Take stibium 40 drachms. acacia 40 drachms,

[1] J. Berendes, *op. cit.*, p. 389.

[2] *The Book of the Ten Treatises on the Eye Ascribed to Ḥunain ibn Isḥāq (809-877)* p. 125.

[3] T. Puschmann published the Greek text and German translation (Vienna, 1878-79) 2 vols., *idem, Nachträge zu Alexander Trallianus...*, *Berliner Studien für classische Philologie* (GBerlin, 1887) vol. 5.

cadmia 6 drachms, myrrh 4 drachms, aloe 2 drachms, nard and Indian lycium 4 drachms of each, castor 1 drachm, burned and washed copper 14 drachms, white lead 8 drachms, opium 2 drachms, yellow burnt vitriol 2 drachms, gum arabic 40 drachms. Knead these remedies with the water of a decoction of roses; apply the eye salve with white of eggs and dilute it well. Thus, it will be quite excellent.[1]"

Another reads :

"Recipe for an eye salve, named after Paccius, and called Asclepiadeum,[2] useful for excessive pain, thin and refined matter flowing to the eye, for transforming dirty ulcers occurring in the cornea, for pustules, night-blindness, trachoma, and chronic diseases; it is useful for those whose eyes have been damaged by the excessive use of collyria. It is efficacious from the very first hour. Cadmia 12 drachms, copper scales 12 drachms, myrrh 4 drachms, hematite 4 drachms, Indian nard 4 drachms, dry roses 4 drachms, opium 4 drachms, white pepper 14 drachms, gum 12 drachms; pound the remedies with as much wine from Chios as suffices and apply with white of eggs.[3]"

Thābīt ibn Qurra (d. 901) of Ḥarrān, Mesopotamia, was an important translator from Greek and Syriac into Arabic. He was a mathematician and astronomer, and a physician.[4] For his son he wrote the *Al-dhakhīra fī ʿilm al-ṭibb*, "Treasury on the science of medicine.[5]" The diseases are enumerated according to their etiology and sometimes according to the part of the body concerned. The prescriptions are largely taken from Galen's works. A short one from this text will suffice as an example.

"Prescription for a good syrup to stop menstruation, aid hemorrhoids, and restrain the abdomen and most leucorrhoeas. It strengthens the stomach, and is useful for the spleen, for ascites, and improves the complexion. Preparation : Iron scoria, incense bark are wetted with a constipating syrup. It is taken before and after meals. It is useful for hemorrhage of the stomach...[6]"

[1] M. Meyerhof, *op. cit.*, p. 133.

[2] This prescription is from Galen, Kuehn ed,. XVII, p. 772.

[3] *Ibid.*, p. 140.

[4] *Cf.* F. Wuestenfeld, *Geschichte der arabischen Aerzte und Naturforscher* (Göttingen, 1840 pp. 34-36).

[5] G. Sobhy, ed., *The Book of al-Dhakhīra* (Cairo, 1928).

[6] *Ibid.*, p. 118.

Al-Rāzī (d. 925) was born in Rayy near Teheran and spent most of his life in Baghdad. Since he was one of the greatest chemists of the Muslim period and also one of its greatest clinicians, his pharmacological knowledge is of enormous interest to students. Most of his largest work, *Al-Ḥāwī*, "Continens," has now been published in the original Arabic.[1] He also wrote a smaller work compiled mainly from Greek sources, *Al-kitāb al-Manṣūrī*, in Latin "Liber Almansoris.[2]"

Prescriptions from other works of al-Rāzī follow :

In his *Maqāla fī al-ḥaṣat fī al-kulā wa'l-mathāna*, "Treatise on the calculus in the kidneys and bladder," the following prescriptions appear :

"Recipe for a remedy which strengthens the fresh scar found in the kidneys, the ureters or the bladder. Take one part of Armenian bole, two parts of incense, two parts of dragon's blood plant, a sixth of washed acacia, and as many watermelon seeds; then prepare it in the form of pastilles with plantain juice. Each pastille is one *mithqāl*. One is administered with water two hours before and one ten hours after the meal."

"Recipe for a remedy which one injects into the urethra to strengthen the fresh scar : equal parts of ceruse, bole, incense and dragon's blood plant; a tenth of opium. It is made into a *shiyāf*.[3] When one needs it, one triturates it into a shell with plantain juice or with a dry decoction of roses, or with the seed mucilage of flax. It is injected into the urethra. When there is heat and a sharp pain, one injects into the urethra some woman's milk or mucilage of quince, or mucilage of seed of flax macerated in water in which earth is dissolved or gum [arabic] or gum tragacanth. One gives the sweet grain, and when the sharpness is eased, one adds the strengthening drugs.[4]"

Al-Fākhir, a work on therapeutics, was compiled by al-Rāzī. An excerpt is given by de Koning.[5]

"Diuretic remedy. Take [equal parts of] cucumber seed, melon

[1] Hyderabad, 1955-1966, from the Escurial manuscript.

[2] Milan, 1481 and many times later. Al-Rāzī's work is largely Galenic in theory but he often diverged widely in practice.

[3] A type of collyrium for the eyes.

[4] Arabic text edition with transl. by P. de Koning, *Traité sur le Calcul dans les Reins et dans la Vessie* (Leyde, 1896) pp. 46, 48.

[5] *Ibid.*, pp. 57-123. The present quotation is from p. 72.

seed, gum of prunes, and seed of endive. The dosage is two *mithqāls* in two ounces of oxymel. It is for those who have a hot temperament.

"Another remedy, which is not compounded, which cleanses and breaks up calculi and which does not overheat. One drinks a *mithqāl* and a half of bitter almonds in an ounce of raisin rob.

"Another remedy which has the marvelous virtue of breaking up the calculus. Take burned scorpion, powder of Jewish stone, stone of the sponge—each two *dāniqs*, and this is the dose. This remedy breaks up the calculus by a certain property of its nature. It may be employed in all circumstances since it is not necessary to counterbalance it or to guard against it by another drug. This remedy composed of the three simples is taken with a clear white wine or with clear honeyed water."

'Alī ibn al-'Abbās al-Majūsī (d. 994), known as Haly Abbas, a Persian, in his *Kitāb al-malakī, (Liber regius)*, also discusses the therapy for calculi in the ninth section of the first part.[1] Al-Majūsī gives an elaborate description of illnesses of the kidneys, their etiology ,and symptomatology. Then he carries on with a chapter on the bladder. This is preliminary to a complete discussion of the causes, symptoms, and treatment of calculi in the kidneys and bladder. Al-Rāzī, throughout, is concerned with the transformation of the Galenic humors. First, the nutriments to combat the humoral excess, the cause of calculi, are described. One of the compound remedies described is :

"The patient, from time to time, takes the following decoction whose formula is : twenty jujubes, thirty [fruit] of sebesten, ten white figs, some maidenhair, licorice root, marshmallow seed, some seed of mauve, some seed of smallage, of fennel, of galingale, some of caltrop and thyme—of each in the necessary quantity. It is all boiled with three *raṭls* of water until it is reduced by one-third. It is filtered. When administered, four ounces of it is given with one ounce and a half of oxymel prepared with some sugar.[2]"

For the treatment of calculi which have been completely hardened, there are prescriptions to break them up. One reads :

"One takes three dirhams each of ginger, downy germander, Indian nard, the fruit of the balm-tree, four dirhams each of cinnamon [bark], flower of the odoriferous rush, of hart's tongue, saffron and castoreum,

[1] Reproduced in P. de Koning, *op. cit.*, pp. 125-185.

[2] *Ibid.*, p. 144.

two dirhams each of *Acorus calamus*, cabaret, long pepper, madder, and costus, and one dirham of false cinnamon, and two and one-half dirhams each of parsley, roses, and white pepper. It is all pulverized and prepared with some honey bereft of its foam; the dose is one dirham in water in which one had boiled black chick peas.[1]"

Following an operative procedure for calculi, al-Zahrāwī writes : "Fill up the wound with some incense, aloe, dragon's blood, and apply a bandage, then a compress soaked with olive oil and wine or rose oil and fresh water to arrest any tumerous inflammation.[2]"

"After three days, an embrocation is placed on this spot, composed of water and much oil, then finally with palm plaster and a basilicon plaster.[3]"

Al-Zahrāwī and al-Majūsī were both dependent, in making up their prescriptions, on the Galenic humors. From what has already been described of the *Liber regius*, one knows that this work was organized in a remarkable fashion. Al-Zahrāwī of the West, and indeed al-Majūsī of the East, were great pharmacologists in the latter part of the tenth century. Although the latter was more interested in etiological aspects of medicine, he did not neglect the growing importance of drugs. It is to the credit of al-Zahrāwī, in spite of his deep interest in surgery, that he was a leader in the West in the use of medicinal therapy.

One thing very noticeable by the year 1000 A.D. is the lessening of emphasis on the necessity to give the four degrees of the cold, warm, moist or dry humor for simples. The Galenic theory had subsided in importance by this time so that, in the main, an unquantified elementary theory of opposites still existed. Fever was treated to cool the patient; dryness was treated by liquids, and diarrhea, for example, required the prescriptions of drying drug. After the middle of the eleventh century, the four degrees of each humor were of little or dying significance in writings on medical therapy.

Ibn Sīnā (*ca.* 1000), in his discussion of disorders of the skin [4] in

[1] *Ibid.*, pp. 153, 155.

[2] *Ibid.*, p. 272.

[3] This is described by Avicenna as consisting of wax, pitch, myrrh, pine resin, pistachio resin, and olive oil.

[4] O.C. Gruner, *The Canon of Medicine of Avicenna* (London, 1930) book I, p. 378; M.H. Shaw, *Avicenna's Canon...* (Karachi, 1966).

the chapter on nutrition, gives a remedy for furunculosis. It attempts to treat the symptoms, but it is ineffective.

"Pimples forming all over the body. If they are ulcerating and black, it is a fatal sign. If they resemble aphthae, it is also mortal, especially when they spread out. If they are white, it is more hopeful. If red, it is also more hopeful. If they come out freely, it is a better sign.

"The treatment in all cases consists in using fine desiccants dissolved in the bath-water, such remedies as rose, myrtle, mastic-leaves, tamarisk, and their respective oils being boiled in the water. If the furuncles are healing, they should be left alone until they are mature; and they are then treated. If they are ulcerated they need an ointment of ceruse. They may need bathing with honey-water and a little nitre, as one does with aphthae. If they scab over it will be necessary to use something stronger. One therefore bathes them with aqueous borax mixed with milk, to enable it to be borne. If they become vesicular, they should be steamed, and have water poured over them in which myrtle and rose and schoenus, quinsywort, and leaves of the mastic tree have been boiled."

Ibn Sīnā leaves no doubt as to how he makes his choice of medicines.

"There are three rules to follow in selecting medicines : selection according to quality—whether cold, hot, moist, dry; selection of the dose according to weight and degrees of hot, cold, etc...; the rules relative to the time of administration..."

"Once one knows the quality of the malady, the appropriate medicine is that whose quality is exactly opposite.[1]"

"When an intemperament occurs without [unhealthy] matter, the treatment is to alter it; but if there is abnormal matter, this has to be evacuated. Usually a single evacuation will suffice to amend the previously existing intemperal state; but sometimes it is not sufficient for the purpose, and the intemperament will then require rectification, after evacuation has been effected.[2]"

It is not often that a drug is recognized as having a special physiological effect in treatment. Ibn Sīnā, in his treatise on the eyes gives an instance of this type of therapy which disregards humors.

[1] *Ibid.*, p. 463.

[2] *Ibid.*, p. 469; *cf.* also the rest of book I in this volume for the reasons for the uses of drugs.

"He must have egg whites beaten with rose oil on the eye while he sleeps. His head must be moistened with various media and oils, and compresses and head detersives made out of violet and water-lily oil. When the condition of the ailment indicates that it is associated with dryness of gall-like matters, then remove it with violet oil and lesser bindweed. The latter possesses a specific effect.[1]"

The most original of Muslim ophthalmologists was Abu'l-Qāsim 'Ammār ibn 'Alī al-Mauṣilī (fl. under al-Ḥakīm in Egypt 996-1020) who wrote on the treatment of the eye, *Kitāb al-muntakhab fī 'ilāj al-'ain*. It is arranged in a logical fashion. The German translation has been published.[2]

Al-Mauṣilī states :

"In the treatment of ulcers, the best for treatment is the following collyrium. It effects healing and allows natural flesh to grow there so that, after the cure, no spot remains in the eye. Watch that when the ulcer is treated with anything else. The eye must be bound from the beginning of the ailment.

"Prescription for lead collyrium for ulcers. Take 8 dirhams each of gold colored calamine, white lead and burnt copper, 4 dirhams of burnt lead, 30 dirhams of antimony sulfide, 8 dirhams each of strong gum arabic and tragacanth, 1 dirham each of myrrh and opium, and 5 dirhams of incense. These drugs are put together, pulverized, sieved, and kneaded with potable water. Small cakes are made of them which are dried in the shade, then used.

"Watch that when using a mineral drug which has not been properly pulverized for the remedy which is used in ulcers it should not prick the eye. Be careful in the same way with other remedies. I myself have treated ulcers with this remedy all my life. It is the best.

"If a small spot remains, then prepare a calamine collyrium so that no other be used. Prescription [of the calamine collyrium]. Five dirhams of white lead, 2 dirhams each of gum and tragacanth and 1 dirham each of opium and silver colored calamine are gathered, pulverized and sieved, and kneaded with rainwater and egg white. A

[1] J. Hirschberg and J. Lippert, *Die Augenheilkunde des Ibn Sīnā* (Leipzig, 1902) p. 103, extract from *Qānūn*, book III, part III, section II, chapter 6.

[2] J. Hirschberg, J. Lippert, and E. Mittwoch, *Die arabischen Augenärzte nach den Quellen Bearbeitet* (Leipzig, 1905) part II.

collyrium is prepared from it and some rubbed with milk when it is needed and dripped into the eye.[1]"

Contemporary with al-Mauṣilī was ʿAlī ibn ʿĪsā who flourished in Baghdad in the early part of the eleventh century and wrote "A Manual for ophthalmologists," *Tadhkirat al-kaḥḥālīn.* This work is the second oldest complete text extant in Arabic on the eyes. It is based on older texts as well as personal experience. We are interested in the third part which includes general ophthalmological medicine. He describes the effects of 143 drugs. Prescriptions are given in great quantity and details are not spared. Some of these are :

"Prescription for a collyrium which sharpens and strengthens the sight. Take equal parts of sagapenum resin, opopanax resin, saltstone, verdigris, white pepper, asafetida, balsam oil, gall of a bull, long pepper, and ginger. The number of drugs is ten. These are kneaded with fennel juice after which it is finely pulverized. The eye is rubbed with it.

"Also when you dissolve a little opopanax resin in basil juice, it is useful when it is rubbed in the eye. Or one may take the juice of green, unripe pomegranates, it is cooked down to its half, then honey is added, and then it is left for 20 days in the sun; it is rubbed on to sharpen the sight."

In the *Kitāb al-murshid wa'l-kuḥl,* al-Ghāfiqī describes treatment for pustules of the eyelid. It is of interest when considered together with his great work on simple drugs. Throughout this text on ophthalmology, the author is well oriented toward the use of drugs, both internally and externally. [2]

"These are hard and small pustules and appear especially on the eyelids of adolescents and young girls. They originate from a thick vapor. Treatment : It is necessary to approach the eyes with two droppers. From one, there comes out very hot water in which has been boiled dill, camomile, and melilot. Then, the eyelid is coated with juice of wild cucumber or take finely powdered Yemenite alum. Then take after that terebinth gum; put it in a small fire and pour alum in it. Finally, put it on the pustules to extirpate them. Take some natron and gum arabic in equal parts. Pulverize them with a

[1] *Ibid.,* pp. 100-101.

[2] *Ibid.,* part I, by J. Hirschberg and J. Lippert (Leipzig, 1904) p. 273; Arabic text (Hyderabad, 1964) ed. by Sayyid al-Sharafi.

palm branch and apply. If that does it, it is good. If not, then open the cephalic veins...[1]"

ʿAlī ibn Hubal, already mentioned as the author of "Book of selections on medicine," flourished in Baghdad.[2]

In his treatment of calculi, the patient "drinks remedies which make [the calculus] slip, as the pulp of cassia with almond oil... If this therapy has no effect, then one administers remedies which break up the calculus and which are good for evacuation. These are the following : root and seed of marshmallow, mallow and its seeds, asparagus and its seed, the seed and extract of horseradish, seed and extract of lucern, the caltrop and its extract, lily root, maidenhair, celery seed, seed of [wild] mountain smallage, fennel, tomentous germander, thyme, hart's tongue, seed of mahaleb, bitter almonds, fruit of balsam tree, its wood and oil, seed of ben..., Roman nard, black and white pepper, ginger, pyrethrum, gentian, laurel...[3]"

Khalīfa al-Ḥalabī (*ca.* 1256), of Aleppo as his name indicates, wrote a comprehensive work *Kitāb al-kafī fī al-kuḥl,* "Book on the adequacy in ophthalmology." Although he mentioned eighteen major ophthalmological texts, ʿAmmār's was not quoted. The medical influences on al-Mauṣilī and al-Ḥalabī, in Egypt and Baghdad respectively, were such as to permit them to develop new materia medica for the eyes. Al-Ḥalabī's work is a very practical one. The text has a good description, for example, of the operation for cataract and the necessary surgical instruments. After the operation, it is suggested that one "drops into the eye the water of chewed cumin and salt. Then a compress is put on it and egg yolk with rose oil is applied. A bandage is wrapped over both eyes so that they will not move...[4]"

Ṣaliḥ al-Dīn of Syria wrote "Light of the Eyes and Anatomy of the Parts," *Kitāb nūr al-ʿuyūn wa-jāmiʿ al-funūn* (*ca.* 1296). His authorities are mentioned in the text; they go in time from Galen to his contemporaries. Included are Dioscorides, al-Majūsī, ibn Sīnā, ibn

[1] M. Meyerhof, transl., *Le Guide d'Oculistique... al-Ghāfiqī* (Barcelona, 1933). The text is absent from this edition.

[2] The book was published in four volumes in Hyderabad, 1364 H. The section on calculi was published by P. de Koning, *op. cit.*

[3] De Koning, *op. cit.,* p. 197.

[4] Hirschberg, Lippert, and Mittwoch, *op. cit.,* part II, pp. 187-188.

Zuhr, al-Zahrāwī, Ḥunain, ibn Qurra, ʿAlī b. ʿĪsa, ʿAmmār, abū al-Bayān, al-Rāzi, ibn Jazla, and others.

All of these are frequently quoted to give a book full of remedies interesting for comparative purposes. For example, a prescription from Book II of *Al-Ḥāwī* of al-Rāzī reads :

"Prescription for a salve... which is used for the beginning of a cataract. Take ginger, pepper, long pepper, cinnamon, and amurca olei, elm ash, calamus, gum of the wild oil-tree, roots of the greater celandine, ashes of the bat, ashes of the swallow, ammoniacal salt, wolf milk, asafetida and sagapenum. It is pulverized and moistened with goat or fish gall until it may be kneaded. A collyrium is made of it and rubbed in with rue extract.[1]"

In recaptitulation, the medical texts, in collation with other types of texts, indicate the same changes, a trend toward the greater diversification of the materia medica, a tendency toward greater freedom in contrast to the early rigidity of the theory of the four humors. A tendency away from the use of the Mediterranean Galenic and Dioscoridean drugs is seen as a necessary process with the development of drugs ranging widely from Spain to India and from the Sahara to Europe. The old theoretical ideas were loosened from their moorings into a vast area where the basic ideas of pharmacology had to change because of the tide of new ideas, new materia medica, and serious questioning of classic explanation.

[1] *Ibid.*, p. 245.

CHAPTER EIGHT

POISONS AND ANTIDOTES IN SPECIAL TEXTS

Pre-Islamic Toxicology

Among primitive men, people of antiquity, and those up to the present day, the subject of poisons and their therapy has always attracted great interest. One has but to review the history of the more narrow area of arrow poisons to be impressed with the extensive literature. This has been done on a global scale by Lewin [1] in great detail demonstrating that primitive and prehistoric men possessed a wide knowledge and that they still use many kinds of poisons. These were and are primarily of botanical origin.

It is no surprise then to learn that the oldest literatures, of the ancient Mesopotamians and Egyptians, abound with mention of toxicological matters in the medical tablets and papyri still extant. In the medical literature of ancient Babylonia, frequent reference is made to various types of poisons of botanical and zoological origin. The Sumerians and Akkadians knew such poisonous plants as the black nightshade,[2] spurge,[3] and crowfoot [4] among others. They also treated snake and dog bites as well as the ill effects of scorpions and spiders. Vinegar [5] was often used as a therapeutic agent to remove certain poisons; thousands of years later vinegar was still being used in this manner. Anise,[6] another example, was considered efficaceous in a poultice for poison when compounded with other drugs.[7]

[1] L. Lewin, *Die Pfeilgifte* (Leipzig, 1923).

[2] *Solanum nigrum* L., *GEŠTIN.LUL.A.* in Sumerian, *karan šelibi* in Akkadian. It was used in ancient Babylonia in beer for scorpion sting. It was also used for the eyes, in clysters, and for strangury for catheterization to "fill the middle of the penis" (AM 62, 1, ii).

[3] *Euphorbia helioscopia* L. *GI.RIM.SIG.* in Sumerian and *ḫassaratu* in Akkadian. The juice is poisonous. It is cognate to Syriac *ḥ'sar* (DAB 149). It occurs with other poisonous plants in a lexical list.

[4] Probably *ellību* in Akkadian and *GI.RIM* in Sumerian (DAB 144).

[5] *BIL.LA* in Sumerian.

[6] *Šamaranu* in Akkadian.

[7] R.C. Thompson, *Assyrian Medical Texts* (Oxford, 1923) no. 91, l.8.

In Egyptian medical papyri, poison is seen to be an ever present agent. Snake bite was treated by a charm so that the vessels of the body would not take up *šśp* "the excretion of sickness.[1]" The Ebers papyrus contains many poisons such as metallic salts, opium, and hyoscyamus but they are not referred to as such.[2]

From India have come many medical texts which contain copious material on poisons. The most famous of these are the Charaka and Susruta *saṃhitās*. Charaka,[3] a physician, probably lived in the second century A.D. but his *saṃhitā* preserves the Indian medicine of many centuries, and perhaps a millennium, earlier. Susruta [4] was probably a younger contemporary of Ātreya's pupil, Agnivesa, most likely of the sixth century B.C. These two works are of an encyclopedic nature; both contain much on poisons, and are much larger than the treatise by Shānāq mentioned previously.

Caliph al-Ma'mūn,[5] because of his interest in the sciences, invited many foreign scientists to his court from Jundīshāpūr where there were not only Greek men of science but also Indians who had brought their science and wisdom. There can be no question of Sanskrit sources being available to Arabic writers.

To simplify the question of the Indian sources of ibn al-Waḥshīya in this present work, the Shānāq text has been taken as a representative example of Indian work [6] on poisons. A brief comparison of the Shānāq and Susruta texts demonstrates the truth of this.

In the section on toxicology, Susruta includes the following eight chapters[7]:

Chapter 1 Mode of preserving food and beverages from the effects of poison.
Chapter 2 Effects, nature, and operation of *sthávara* poisons.
Chapter 3 Animal poisons.

[1] J.H. Breasted, *The Edwin Smith Papyrus* (Chicago, 1930) p. 475.
[2] H. Joachim, *Papyrus Ebers* (Berlin, 1890).
[3] Abinash Chandra Kaviratna, transl., *Charaka Saṃhitā*.
[4] Kunja Lal Bhishagratna, transl., *Susruta Saṃhitā*. *Cf.* Max Neuberger, *Gesch. d. Medizin* (Stuttgart, 1906), p. 176; ibn abī Uṣaibi'a, *Kitāb 'uyūn al-anbā' fī ṭabaqāt aṭibbā*, "Book of Sources of Information on Classes of Physicians" (Koenigsberg, 1884).
[5] R.A. Nicholson, *A Literary History of the Arabs* (Cambridge, 1956) pp. 262, 358-360.
[6] P. Kutumbiah, *Ancient Indian Medicine* (New Delhi, 1962) pp. xxx ff.
[7] *Susruta Saṃhitā*, vol. 2, pp. 673-762.

Chapter 4 Specific symptoms of snake bite poison.
Chapter 5 Medical treatment of snake bite poison.
Chapter 6 Rat poisoning cases.
Chapter 7 Therapy with drum sounds since it is possessed of anti-venomous virtues.
Chapter 8 Poison from bites and stings of animals such as spiders, scorpions, ants, frogs, stinging flies, mosquitoes.

Of some importance is the fact that Shānāq's work shows that he knew Susruta's compendium. The Indian as well as Greek background of Shānāq has already been studied to some extent.[1] Insofar as its contents are concerned, much of it resembles the Susruta work in a somewhat different order. Shānāq divided his work into five chapters:

Chapter 1 On the poison maiden, the upsetting of the humoral balance in the body by poisons in the form of food, drink, clothing, perfumery, and washing media.
Chapter 2 Poison in raw and cooked food, drinks, fruit juice, conserved fruits, perfumes, salves, aromatic and washing waters, apparel of various materials, and rugs. Symptoms due to poisoned matter and its properties.
Chapter 3 Twelve recipes of animal poisons in foods and drink from the swallow, *saṭūqa*, salamander, blood of various animals, leopard and other kinds of gall, chameleon, heart and tongue of a raven, and frog. Universal antidote, seal ring poisons for suicide.
Chapter 4 Remedies for young swallow, leopard gall, chameleon, and others.
Chapter 5 Recipes to poison salves, washwater and clothes.

It is fairly obvious, as Strauss states, that there are omissions in the Shānāq treatise. Further, its organization has not allowed for chapters which are mutually exclusive in content. However, this may not be the fault of the author but of the copyists and translators. An important point in regard to the contents is that, although the text is a relatively brief one, the subject matter resembles in major detail the much larger poison treatises of Jābir and ibn al-Waḥshīya as well as Susruta, already discussed in this connection. There are also

[1] B. Strauss, *op. cit.*, pp. 24-25.

many common elements between the Indians and Greeks such as Nicander and Paulus of Aegina. These will be demonstrated later on, particularly in the notes to the translation. For purposes of comparison, the Jābirian table of contents is given in brief under Arabic poison literature. It should be compared with that of ibn al-Waḥshīya to note the interesting similarities and differences.

Indications point to the idea of a common source for Indian writers on poisons. Some other Indian works, besides that of Shānāq, were used by ibn al-Waḥshīya in his writing : these are the treatises of Tammashah and Bahlīndad, both of these being referred to as Indians in the text.[1] Another Indian, called Bai, Nai, or Tai, depending on the missing diacritical marks, is mentioned in the literature but his work is not extant.[2]

There were many other writers on poisons in pre-Islamic times. Persian and Egyptian sources are given in ibn al-Waḥshīya's rich introduction. Syriac language treatises, from which ibn al-Waḥshīya professed to have obtained most of his material, are also listed by him.[3] Al-Rāzī frequently mentioned a Simeon in *libro suo quem composuit de venenis.*[4]

Ibn al-Waḥshīya mentions Greek authors as Alexander, Dioscorides,[5] Theophrastus,[6] and Galen. Andromachus Senior and Andromachus Junior, both mentioned in Galen,[7] are considered authorities on poisons and antidotes.[8] Not all of Galen's works on poisons are extant today. Hermes (?) and Joannes Philoponus (6th cent. A.D.) are known to have written on toxicology. The manuscripts are known today.[9] Al-Rāzī mentions a Philaretus who wrote on poisons. A Philagrius is cited by both ibn Sīnā and al-Rāzī. Then there is a Xenocrates in ibn al-Baiṭār.

[1] Ibn al-Waḥshīya MS Velieddin 2542, fol. 141a. See M. Levey, *Medieval Arabic Toxicology.*

[2] M. Steinschneider, *Virchow's Archiv 52*, 349, 491 ff. (1871).

[3] *Vide* M. Levey, *op. cit.*, for ibn al-Waḥshīya's introduction and bibliography.

[4] See M. Levey, *op. cit.*

[5] The subject of toxicology was greatly enlarged upon after Dioscorides by Greek and especially Arabic writers.

[6] Arthur Hort, editor, *Theophrastus' Enquiry into Plants* (London, 1916).

[7] Kuehn, *op. cit.*, vol. 14, p. 32.

[8] *Ibid.*, p. 42.

[9] M. Steinschneider, *Mém. de l'acad. des sciences de St. Pétersbourg 13*, 152-176 (1869).

The most important of Greek writers whose poison works are still extant was not known to ibn al-Waḥshīya. He was Nicander of Colophon (fl. *ca.* 240 B.C.). On the subject of poisons, he wrote two fairly long poems, one on theriacs and one on antidotes.[1]

Nicander's works with which we are concerned are the *Theriaca*, a poem of 958 lines, and the *Alexipharmaca*, 630 verse lines in length. These are the earliest extant texts on this subject in Greek. It is certain, however, that Nicander was not the original authority nor was he in contact with one. Nicander's *Prognostics* was a paraphrase of Hippocrates, and his *Georgics*, according to Cicero, revealed no competence in theme. The same is true for his *Theriaca* and *Alexipharmaca.*[2]

In the *Theriaca*, the principal source for Nicander was the *Perí therion* by one Apollodorus who probably lived at the beginning of the third century B.C.

In the work of Apollodorus, his botany seems to have been restricted to medicinal and poisonous plants. Wellmann[3] has shown that this author as well as Theophrastus and later Greek writers on pharmacology were deeply indebted to Diocles of Carystus, of the Sicilian school of medicine of the fourth century B.C. He is supposedly the earliest to have described in Greek the effects of plants upon the human body.

The folkloristic sections of Apollodorus, as in the tales of ibn al-Waḥshīya, are probably of his own fabrication or, more simply, stories told by the people. As in ibn al-Waḥshīya, many of the animals discussed are difficult to identify with exactitude. Nicander discusses sea hares, salamanders, leeches, wasps, blister beetles, and various small insects and creatures, not much unlike the descriptions of the

[1] These works will be described after a brief notice about the author himself. Nicander was born in Clarus, (*Theriaca*, line 958) a seat of the cult of Apollo and also location of Germanicus' visit to it. This town was close to Colophon which also laid claim to Homer and gave us such greats as Mimnerus, Xenophanus, Antimachus, Hermesianax, and Phoenix. For major references, *vide* the important edition of Nicander by A.S.F. Gow and A.F. Scholfield (Cambridge, 1953) p. 5. Dionysius of Phaselis stated that Nicander spent much time in Aetolia. The dating of Nicander from incomplete evidence places him some time between 254 and 220 B.C.

[2] Gow and Scholfield, *op. cit.*, p. 18.

[3] M. Wellmann, "Das aelteste Kräuterbuch der Griechen," *Festgabe f. F. Süsemihl* (Leipzig, 1898).

fauna of ibn al-Waḥshīya. Many of the same plants are found in both works; the same difficulties of identification hold true for the flora.

On the first page of the *Alexipharmaca*,[1] the aconite plant "which the banks of the Acheron [2] put forth" is discussed as a lethal poison, indicating early transmission of the knowledge of aconite from India to Greece. There must have been cultural interchange in the latter part of the fourth century B.C. and later so that the Indian Shānāq text and, in turn, ibn al-Waḥshīya mention plants of the Mediterranean region. Communication among the three great centers of ancient civilization. Greece, Babylonia, and India began in the second millennium B.C. and continued to develop more and more with time.[3] Very little new material on poison is developed in Galen and Dioscorides.

Much later on came the *Tetrabiblon* [4] of Aëtius who lived *ca.* 527-565 A.D. His work is eclectically compiled and based mainly on Galen and Archigenes. It is of historical value since it contains extracts from many ancient medical works.

Paulus of Aegina's encyclopedia,[5] when translated into the Arabic, proved to be very influential in Muslim medicine. The fifth book is devoted to poisons and antidotes. It is not nearly so extensive as the Jābir and ibn al-Waḥshīya works but bears strong marks of similarity. Quotations in the notes of this present book will demonstrate this.

"Also, the use of mandrake is followed very soon by deafness and weakness resembling the sleep of death so that the pain does not become separated from the mentioned desire for sleep. Before any of this occurs, warming has a good effect. Honey meal, natron, and wormwood with a sweet wine or sweetened wine are administered. The head is moistened with rose oil and vinegar. Further rousing in the movement of the settled body is by aromatics as pepper, mustard, castoreum, and rue which are rubbed with vinegar, tar, and lamp black. When it is difficult to wake up the victim, then one may use sternutators and other means.[6]"

[1] Gow and Scholfield, *op. cit.*, p. 95, line 12.

[2] Acheron is a fabulous river in Hades.

[3] *Cf.* especially the works of Professor Cyrus H. Gordon on the decipherment of the Cretan language now called Linear A.

[4] Book XIII, edited by Sk. Zervos (Syros, 1908). This book is on poisonous animals and antidotes.

[5] J. Berendes, *op. cit.*, pp. 421-465.

[6] *Ibid.*, p. 455.

Altogether there are sixty-six chapters on poisons. Included is a chapter on a general antidote for poisonous animals.

"In the study of poisonous animals we begin with what usually is essential in all these circumstances, in that we consider the antidotes. When someone, because of compelling reasons, must stay overnight in a place where there are many salamanders, spiders or snakes, then one must put garlic rubbed plants at the opening of the hiding place, then to build a smoke with deer horn, goat hooves, goat hair, lignite, asphalt, bdellium, galbanum, cypress, or cedar with black cumin, hair, chaste-tree leaves, mint, sagapenum, or any other of the strongly aromatic plants. Mosquitoes are driven away especially by a smoke from copper vitriol, black cumin seeds, and cumin in equal quantities with cow dung. A burning fire helps since wild animals seem to fear most its brightness...[1]"

The symptomatology is very brief and the therapeutics is somewhat more expanded but the entire discussion is as an abstract compared with the contents of Jābir and ibn al-Waḥshīya.

Early Arabic Toxicology

The most complete Arabic work on toxicology before ibn al-Waḥshīya still extant is that of Jābir. Based on both Greek and Indian works, it covers the field in great detail. The date when it was written is unknown but it must have been some time in the ninth century A.D. It is mentioned by ibn al-Waḥshīya.

Jābir's *Kitāb al-sumūm* "Book of Poisons" is divided into six chapters[2]:

Chapter 1 Humors and reactions of the body to poisons.
Chapter 2 Names of animal, plant, and mineral poisons.
Chapter 3 Effects of poisons on the body and organs.
Chapter 4 Symptoms of specific poisons and diagnosis. Bites and stings of animals.
Chapter 5 Compound poisons.
Chapter 6 Prophylaxis for poisons. Antidotes and remedies in general.

[1] *Ibid.*, p. 423.

[2] A. Siggel, *Das Buch der Gifte des Jābir ibn Ḥayyān.*

Jābir does not always adhere to his writing plan and so the book is full of much valuable tangential material for chemistry, medicine in general, and pharmacology.

The following discussion from Jābir indicates his style of description :

"Description of Compound Poisons and Symptoms They Cause"

"The study of the kinds of poisons and the form of their occurrence, may Allah give you power and make you successful, are elaborated upon in this section; for it is something which points to understanding of the causes in the effect and to the quality of their mixture. By these means, it gives rise to those effects and at certain times the appearances of the effects as a result of the combination of things with one another. I say, now, that this section belongs to that part where we have already spoken of the substantiality of poison medicines, and regarding their effect in special instances and similar ones. Therefore, we have made up the example of the doughs and powders of the physicians, of the transformation of their qualities after long duration and through ageing, and that which follows on standing. I say also to whoever looks for them that these poisons are employed more easily, simpler, more discrete, and are more available to people for the purposes required although much is still unknown—for it is seldom that one may find a trusted one with the information. Further, I say that there are such combinations and poisons whose effects are more useful and unusual than those which we have already described. In this connection and their association, the wise one can turn it to advantage in various avenues. You will see it, recognize and know the method when we get into the explanation, if Allah wills."

Jābir describes some of these poisons as follows :

"Another (poison) of this kind : Take a gecko and a yellow tarantula, then pulverize them both finely; they are mixed with milk and left there to ferment. Then it is cooked with those things in which milk is purified. This is one of the important poisons.

"Another of this kind : The mad dog is mad by nature or because of spoiled food, and may become mad because of its handling, as we have related. Whoever takes a little of his saliva or especially of his gall or spleen, dries it, and mixes it into foods or the like which are not sweet, then it is immediately lethal similar to hydrophobia, and in the same length of time.[1]"

[1] *Ibid.*, fol. 212b.

"Another of the same type : Take a gecko bitten by a scorpion and a tarantula, as we mentioned at the beginning. They are pulverized. Then the spleen of a mad dog, one quarter of its amount, is pulverized with it until it is dust-fine when it may be used. When this is thrown into cooked food, then it has a lethal effect. Also, when it is thrown upon sweets, it is deadly. When it is put into medicines it is lethal as also when it is baked into bread. It kills as those ailments do which are similar to rabies and pest-illnesses. It belongs to the important poisons."

Next chronologically, is Yaḥyā ibn al-Biṭrīq (fl. *ca.* 815).[1] He is cited by ibn al-Waḥshīya as having translated poison texts from the Greek.[2] Yaḥyā translated Galen's work on theriacs and commented on the book of Shānāq.

'Alī b. Rabban al-Ṭabarī (b. *ca.* 810), in his great work,[3] "Paradise of Wisdom," discusses poisons and their therapy.[4] Al-Ṭabarī is also famous as a teacher of al-Rāzī.

The son of a pharmacist, ibn Māsawaih,[5] called Mesue Senior in Latin, lived in Jundīshāpūr. In Baghdad, he studied under Jibrīl b. Bakhtyashū'. He wrote in Syriac and Arabic and was the teacher of Ḥunain ibn Isḥāq. He is known to have written a work on toxicology which is not known to be extant now. Al-Rāzī used Ḥunain's work on "Theriaca.[6]"

A work on toxicology was written by the famous al-Kindī (813-873) [7] but this is now lost. Another work of his own on the bite of a mad dog is also no longer extant. Ibn al-Waḥshīya mentions the latter book.

Another well known scholar, Thābit ibn Qurra,[8] in his *Kitāb al-dhakīra fī 'ilm al-tibb*, has a short chapter on the subject of poisons.[9] Qusṭā ibn Lūqā (fl. *ca.* 870) [10] was an excellent translator who lived in Baghdad and died in Armenia. Ibn al-Waḥshīya states that he used

[1] Brockelmann I, p. 203.

[2] *Cf.* Steinschneider, *op. cit.*, 264-366.

[3] *Firdaus'l-ḥikma.*

[4] *Firdaus'l-ḥikma*, "Paradise of Wisdom," edited by M. Z. Siddīqī (Berlin, 1928).

[5] Ibn abī Uṣaibi'a, chap. 8; M. Levey, "Ibn Māsawaih and His Treatise on Simple Aromatic Substances," *Journal Hist. Med. 16*, 394-410 (1961).

[6] Ibn abī Uṣaibi'a, chaps. 8, 9, p. 163 in A. Müller edition.

[7] *Ibid.*, chap. 10. p. 206 in A. Müller edition.

[8] *Ibid.*, *loc. cit.*

[9] G. Sobhy, editor (Cairo, 1928) chap. 25.

[10] George Sarton, *Introduction to the History of Science* (Baltimore, 1927) vol. I, p. 602.

his book on poisons. A disciple of Ḥunain ibn Isḥāq,[1] ʿĪsā b. Yaḥyā,[2] translated many Galenic works into Arabic including Galen's *De antidotis*.

ʿĪsā b. Sāsa, an unknown who, according to ibn al-Waḥshīya, wrote a book on poisons, is probably of the early ninth century.

ʿĪsā b. ʿAlī, a student of Ḥunain ibn Isḥāq, wrote a book on poisons, according to ibn abī Uṣaibiʿa.[3]

Al-Rāzī,[4] in his *Kitāb al-ḥāwī*, has many extracts from Greek and Indian sources as well as his own observations on poisons.

Many medical works were written in Arabic by Isḥāq b. Sulaimān al-Isrāʿīlī (d. *ca.* 932 A.D.). They were translated in 1087 A.D. into Latin by Constantine the African, then into Hebrew and Spanish. A complete edition of his works was published in Latin in Lyon in 1515. Included in his books is a "Theriaca.[5]"

Ibn al-Waḥshīya (9th cent.)[6] wrote the treatise called *Kitāb al-sumūm*, "Book on Poisons."

The pharmacology of ibn al-Waḥshīya is extensive; a brief account from his "Book on Poisons" will yield a brief view of this large volume:

"Description of Another Poison, of the Compound Ones, Which is the Seventh of the Easily Compounded Ones.

"It is obtained from spiders[7] with long legs that are called in all

[1] Brockelmann I, 205; S, I, pp. 366, 444, 898.

[2] *Cf.* M. Meyerhof, *Isis 8*, 709 (1926).

[3] *Op. cit.*, chapter 8.

[4] The Arabic text of the *Kitāb al-ḥāwī* has been published by Osmania University, Hyderabad, India. This text is based on the Escorial manuscript. A better text is now to be found in Istanbul libraries. A Latin translation, *Liber dictus Elhavi* appeared in Brescia in 1486. Later editions followed (G. Sarton, *op. cit.*, vol. I, p. 609).

[5] *Omnia opera Isaaci* (Lyon, 1515); F. Wuestenfield, *op. cit.*, pp. 51-52.

[6] Brockelmann I, 242; S.I, p. 430; *Encyclopedia of Islam 2*, 427; *Fihrist*, pp. 311-312 358; L. Leclerc, *Histoire 2e la Médecine arabe*, vol. I, pp. 307-315.

[7] "The grape spider [causes a man's] eyes to turn red, and a shivering settles on his limbs, and his skin and genitals below grow taut, and his member projects, dripping with foul ooze, and at the same time numbness descending upon him overcomes his hips and the support of his knees." Nicander, *Theriaca* (lines 717-724).

Spiders (singular *ʿankabūt*, plural *ʿanākīb*) were often dangerous. In the Near East, one must still be careful of these creatures. Siggel (fols. 173b-174a) classifies spiders with tarantulas. "The patient is allowed to sit in hot water especially with a covering of clay. This eases the pain... The patient must rest for a period. If the pain returns, then return to the treatment... If there are still some remains of the bite, place on it

languages either *shabath* or *shabathī*[1] which are put into a large glass bottle with a wide mouth. Added to it is the head of a snake with its tail and whatever blood flowed out and five dirhams of good cinnabar with ammonium chloride. All are imbued with the urine of man. The bottle is then stoppered well and hung in the shade in hot air. It is observed until the spiders start to disintegrate and mix with the urine and all becomes black. Then the bottle is opened. In a bowl put two pieces of cotton impregnated with nenuphar oil. Take out what is in the bottle and put it into the bowl. Stir it with an iron rod until it is well mixed. Then leave it in the air until it is well dried. Two *dāniqs* of this will kill one in two or three days at the most. If he is not cured in one and one-half hours, he will perish. It is necessary, for its cure, to use this remedy.

"Description of a Remedy Antidotal to This Poison.

"One dirham each of fruit of the agallochum, white sandalwood, seed of the laurel tree, seed of the black cumin, and wood of dodder, and three dirhams each of sweet basil, leaf of lemon balm and its seed, seed and leaf of the rose, and leaf of the [178b] water mint[2] are pulverized to dust. Extract of lily is sprinkled on it with pulverization [at the same time]. Then it is saturated with lily extract and hung in a glass bottle for ten days until the drugs are dissolved and well mixed. Then the bottle is shaken for another ten days and is left ready [for use]. If you want to use it, make the sick one vomit by taking one dirham of this remedy with hot water and beer. When his belly becomes empty, give him two *mithqāls* [of the remedy] with-

a plaster made of figs and powdered calcium oxide... Often, fruit juice is added. Or one may use a plaster of fig wood ash and potash with a fruit juice."

Paulus (Berendes, pp. 429-430) states that the spider bite appears red and feels like needle stabs. It becomes hot, swollen and itchy. There are also cold shivering, heaviness, cold sweat, diuresis, penis erection, and moist eyes. Warm water eases it. Fig ash with fine salt and wine are plastered on the spot.

Vide al-Jāḥiẓ, *Kitāb al-ḥayawān* (Cairo, 1335-1364 H.) col. 2, p. 21; vol. 5, p. 360.

Al-Qazwīnī, J. Stephenson, ed., *The Zoological Section of the Nuzhatu'l-qulūb* (London, 1928) pp. 44-45, states that the spider in an amulet cures fever; it stops bleeding and drives mosquitoes away.

Cf. M.P. Orfila, *A General System of Toxicology* (London, 1819) vol. 2, pp. 533 ff.

[1] Spider or milliped. There are many species of spider. Nicander lists "starlet," "blue spider," "huntsman," "wasp spider," and "antlet."

[2] *Mentha aquatica* L.

out lily extract—I mean that the lily extract is not excessive—together with five *mithqāls* of an average wine.

"Preparation of Another Poison Which is the Eighth of Easily Compounded Ones.

"One procures the lizard [1] which exists in houses and inns—the larger the better—and adds to it a kind of blister fly which is green and small, having long legs and something like flour on its wings, and which often alights on the trees of the large and small cucumbers. They are both put into a large glass bottle with a wide mouth. On them olive oil is poured and the bottle is stoppered tightly. It is hung in a bakery or kitchen until both animals are dissolved in the oil. If you see that they have been dissolved and consumed, shake the contents of the bottle for three days, then bury it in ass manure for fourteen days. Then take it out; all of what is in it has become black. A *dāniq* and one-half of this can kill in one to two days. The victim has a burning of the palate, a contraction of the opening of the stomach, a violent pain in the bowels, swelling of the tongue, and abundant vomiting. One and one-half *dāniqs* of this poison are given in hot gravy or hot water. If the humour of the victim be cold, then it is fatal in four days. He will die unless he is cured before this by the remedy.

"Preparation of the Remedy Antidotal to This Poison.[2]

"It is obtained from two *mithqāls* each of laurel seed, Aristolochia, germander which has the five leaves, dry sea moss, and seed of the white poppy, and three *mithqāls* each of the crystalline matter attached to the dried leaf of the rose, and cabbage seed. Ten dirhams of amomum and twenty dirhams of crystalline sugar are added. All are pulverized until they become like dust. Then they are kneaded with bee honey which has been mixed in wine. It is left for two months.[3] Two *mithqāls* of its beverage is used with hot water after the poisoned one has vomited, if God wills.

[1] Nicander (p. 187) quotes Soranus that "the lizard produces a blister with blackening and sepsis around it." Siggel (fol. 174b) relates of the lizards *('azāya)*, "Bath of hot water with ash coating, rubbing with oil and everything which one uses for tarantula poisoning [are good for lizard poisoning]." "The lizard has only a slightly harmful effect but it sinks its teeth into one. Many times, it is lethal especially... if it has eaten poison." Siggel (fol. 93b).

The lizard in an amulet is good for fever. Al-Qazwīnī (44).

[2] Literally, "the remedy which opposes."

[3] Ibn al-Waḥshīya in Levey translation, fols. 179a-179b.

"Preparation of Another Poison, also Compound the Ninth.

"Take twenty dirhams each of the blood of a man obtained from the veins of his hand and blood of a black cat from its jugular vein, ten dirhams of the hair of a black cat, and five dirhams of iron saffron. Dry the blood and pulverize it; mix it all by pulverization. Then throw it in a glass bottle and cover it with the urine of a boy who has not yet seen an evil dream.[1] Bury it, after you have stoppered its wide mouth well, in a moist well filled with ass dung for four days. Then take it out and add to it three dirhams of verdigris taken with sal ammoniac. Mix it all well by agitation. Then leave the bottle hanging in hot air for seven days; then use it. One-half dirham of it will be fatal in four days, or about that. It causes violent colic in the navel region, pain in the low [part] of the back, pain in the bowels, bad fantasies which are frightening, constriction in the throat, avoidance of food because of a diminished appetite and a violent thirst, unless it is cured with the remedy which adjusts and its antidotal to this poison. Then he recovers from it.

"Description of a Drug Which is Put into a Shirt, Trousers, or Any Garment Close to the Body, and the Handkerchief They Use to Wipe, and Others.

"One-half dirham of the moist part of the crowfoot plant [2] with its thorn with cooked elbows is obtained with a thin glass. When one-half dirham of it is collected. then one dirham is procured of the milk of the milkweed.[3] The soft part of the crowfoot plant is wetted with this milk and mixed well by stirring the lower part of a thin brass container less than an hour with toothpick [4] wood. Take the tip of this toothpick and defile with it any shirt, trousers, or pillow where they are next to the cheeks and the body. It will surely cause injury and make blood flow. If treatment is delayed six hours or so, then it will kill him. It is necessary to treat him quickly especially when it happens to the end of the penis and the testicles since this is fatal on the spot.

"His treatment is that one dirham each of the stomach of a hare and the brain of a wood-pigeon, and one ounce of camel's milk are

[1] One who has not yet had a nocturnal emission.

[2] Ibn al-Waḥshīya, fols. 145b-146a.

[3] *Calotropis procera* R. Br.

[4] The caltrop is the "toothpick plant."

mixed well and then rubbed on the place where the poison worked. It is then anointed with violet oil or nenuphar oil, then left for a short time. Then sebesten leaf is squeezed and the wound anointed with it [the juice]. Then the entire body is anointed with nenuphar oil, pumpkin oil, and the milk which we mentioned. If this treatment is [1] repeated many times, then he is saved from its gnawing the body and its penetrating into it."

Other writers on toxicology should be mentioned at this point. Al-Tamīmī (fl. *ca.* 970-*ca.* 990) lived in Palestine and Egypt, and wrote much on materia medica and on theriacs.[2] Ibn al-Haitham,[3] who died in Cairo, flourished 996 to 1020. He wrote a treatise on poisons. Not only was he the greatest Muslim physicist but he was also a physician and mathematician. Ibn al-Jazzār (d. *ca.* 1009),[4] of Qairawān, wrote a book on poisons which is still extant. Sulaimān ibn Ḥassān ibn Juljul, about the same time,[5] wrote a commentary on Dioscorides and a work on theriaca. He also wrote treatises in the field of medicine and its history.

Ibn Sīnā, in the tractates in Book IV in the sixth part of the "Canon Medicinae,"[6] is concerned with poisons and their antidotes. They treat of the following topics:

1. Symptoms and antidotes of poisons taken orally—especially mineral and animal poisons.
2. Animal poisons in beverages.
3. Bites of animals especially snakes.
4. Bites of people, dogs, and other large animals.
5. Bites and stings of small poisonous animals.
6. Mineral poisons.

[1] Ibn al-Waḥshīya, fols. 145b-146a.

[2] Wuestenfeld, *op. cit.*, p. 57; E.H.F. Meyer, *Geschichte der Botanik* (Koenigsberg, 1854-57) vol. 3, pp. 174-176; L. Leclerc, *Histoire...*, vol. I, pp. 388-391.

[3] L. Leclerc, *Histoire...*, vol. I, pp. 512-525; H. Suter, *Encyclopedia of Islam*, vol. 2, 383 (1916).

[4] M. Steinschneider, *Die europ. Uebersetzungen aus dem Arabischen...* (Reprint, Graz, 1956) p. 17. *Cf.* on specifica, *Epistola Ameti fil. Abrahami de variis arcanis.* in MS Montpellier 277, MS München 615, and Hebrew, MS München 214.

[5] L. Leclerc, *Histoire...*, vol. I. pp. 430-432.

[6] An excellent Arabic edition of the *Qānūn* was published in Egypt (Būlāq, 1877). A Latin translation by Gerard of Cremona was published in Venice, 1544, and also in 1582, 1595, etc. The best is probably the 1582 edition.

A mediocre Latin edition was published in Venice in 1595 in a translation by Gerard of Cremona.

The greatest scientist of the Muslims was al-Bīrūnī (973-1048) who wrote much on poisons in his *Kitāb al-ṣaidala fī al-ṭibb.*[1] Sa'īd ibn Hibatallāh (fl. *ca.* 1075-*ca.* 1101 in Baghdad) wrote "Compendium of cure of diseases and recognition of causes and symptoms.[2]" The last part of this work is concerned with poisons, bites, and stings[3]. Abu'l-Qāsim (d. *ca.* 1013 near Cordova) discusses poisons in his great medical encyclopedia,[4] a *Vade Mecum.*[5] Ibn Rushd (1126-1198) wrote *Maqāla fī al-tīryaq*, "Treatise on theriacs."

Maimonides[6] wrote on poisons and cures in a small treatise[7] "Treatise on Poisons." It was much cited by medieval authors mainly because of the prestige of the writer rather than its mediocre contents.[8]

The body of knowledge on poisons was one which changed but little over a period of the next 500 years. Throughout the sixteenth century, for example, through works by Peter[9] of Abano, Abbatius,[10] and Mercuriale,[11] the Greeks and especially the Arabs were still the major sources of knowledge on poisons.

[1] M. Meyerhof, "Des Vorwort zur Drogenkunde des Bērūnī," *Quellen und Studien z. Gesch. Naturwissenschaften u. Med. 3*, 1-52 (1933); *idem*, "The article on aconite from al-Bīrūnī's *Kitāb al-Ṣaydana*," *Islamic Culture 19*, 323-328 (1945).

[2] *Al-mughnī fī tadbīr al-amrād wa ma'rifat al-'ilal wa'l-a'rād.*

[3] Brockelmann, I, p. 485.

[4] *Kitāb al taṣrīf liman 'ajiza 'an al-ta'līf.*

[5] The section on the preparation of drugs was published in Latin in Venice, 1471.

[6] Brockelmann, vol. I, p. 462; s, vol. I., p. 835.

[7] A German translation, "Gifte und ihre Heilung," was published by M. Schneider (Berlin, 1873). In French, I.-M. Rabbinowicz published *Mamonides' "Traité des Poisons"* (Paris, 1935). The Maimonides tract was put into Latin in 1305. The Arabic title is *Al-risāla al-Fāḍilīya fī 'ilāj al-sumūm wadhikr al-adwiya al-nāfi' minhā wamin al nuhūsh. Cf.* M. Levey, *Medieval Arabic Toxicology* p. 9.

[8] For later books on poisons, *cf.* J.F. Gmelin, *Allgemeine Geschichte der Pflanzengifte* (Nurenberg, 1803) pp. 88 ff. *Cf.* M. Steinschneider, *Archiv f. Path. Anat. 59*, 63-120 (1873).

[9] *Clarissimi Philosophi et Medici Petri de Abano De Venenis* (Basle, 1531).

[10] Abbatius Baldus Angelus, *De Admirabili Viperae Natura* (Urbino, 1589). This text is noteworthy for its excellent anatomical drawings of snake fangs and their structure.

[11] G. Mercuriale, *De Venenis* (Venice, 1584). *Cf.* also *Baptistae Codronchii Philosophi ac Medici Imolensis De Morbis Veneficis ac Veneficiis* (Venice, 1595).

CHAPTER NINE

SYNONYMATIC TEXTS AND OTHER TYPES

During the early centuries of the Muslim civilization, pharmacological literature was borrowed from all parts of the known world. As a result, the translators into Arabic were often forced to give only the transliterations since they did not know the true meaning of the technical terminology. An earlier analogous situation had taken place when Akkadian began to supplant Sumerian; this gave rise to the lexical lists in two languages.

In early classical times, the herbals gave the Greek and Latin synonyms. Dioscorides gave synonymes some of which he may have obtained from Pamphilos (1st cent. A.D.), the Alexandrian lexicographer. Many synonyms found in the "Materia Medica" of Dioscorides were drawn from sources no longer extant and from languages of which little or nothing is now known. Further philological study of these would be of importance for the history of pharmacology.[1]

In various editions of Dioscorides the titles of paragraphs include such words as African, "Andreae medici," Armenian, "Bessicum," Boeotian, Cappadocian, "Dardana," Egyptian, Ethopian, Gaulish, Spanish, "Istrici," "Lucanica," "Marsum," Osthanis, Pythagorean, Roman, Tuscan, and Zoroastrian.[2] The synonyms were used even after the languages from which some had been drawn, had been extinct for two thousand years.[3]

In antiquity, as in modern times, the same plant was frequently called by different names, and different plants by the same name, in various locations. The illustrated herbals (the earliest by Crateuas of Pontus, *ca.* 75 B.C.) were of no help since the author often knew no botany and the plants were drawn without any experiential understanding.

A Latin translation of Dioscorides was first made from the Greek

[1] For some of this type of work, *cf.* J. de Karabacek, *De codicis Dioscurides Anicae Julianae* (Leiden, 1906) p. 83.

[2] M. Wellmann, *Hermes 33*, 369 (1898).

[3] Charles Singer, *Journal of Hellenic Studies 47*, 24 (1927).

in Italy in the sixth century. Two distinct versions are known as *Dioscorides Lombardus* and *Dioscorides vulgaris*. The latter includes the ancient synonym lists from the Greek.

Although Galen and Paulus give synonyms from time to time, no special consideration is given to this aspect of identification. Galen, however, frequently describes the plants to some degree, most of the time insufficiently, in an attempt to denote the exact botanical.

Two of the most important contributors to synonymic learning in pharmacology were Ḥunain ibn Isḥāq and his nephew Ḥubaish ibn al-Ḥasan. The former translated, among many other works, the "Materia Medica" of Dioscorides and the "Simples" and "Compounded Remedies" of Galen from Greek into Syriac; the nephew translated these into Arabic; thus necessitating much more work and learning in philology.

Another physician to whom fell the lot of handing down many pharmacological terms is al-Rāzī, not only in his great *Kitāb al-Manṣūrī* and *Al-Ḥāwī*, but also in smaller works. One, for example, is his "Usefulness of nutriments and protection against their harm.[1]" The same may be said for the more than 800 simples of ibn Sīnā.[2]

Two of the most interesting works of the Eastern Arabic world were written by ibn al-Waḥshīya, the *Kitāb al-sumūm*, "Book on poisons," and *Kitāb al-filāḥa al-nabatīya*, "Nabatean agriculture." The former, according to the author's own bibliographical sources which he mentions, is a work which was borrowed from the many sources of the times and so its simples and compound remedies come from India, Mesopotamia, Greece, Egypt, Persia, and Arabia. Many of the simples are as yet unidentified.[3] Some of these may have come from the legends and folklore of his Syriac speaking tribes. In the book on agriculture, the same is true in that the extensive valuable data are interpolated by names and descriptions of drugs and botanicals which never existed except in magical and fantastic tales.

Al-Muwaffaq's treatise, mentioned earlier, contains some but not many interesting synonyms, because the author intended the description of each simple to be very brief. Although he claims that the Indian sources are the most helpful, he does not neglect the Greek texts.

[1] *Manāfiʿ al-aghdhiya waʾdafʿ maḍārrihā* (Cairo, 1888).

[2] See earlier chapters which treat of aspects of ibn Sīnā's work.

[3] M. Levey, *Medieval Arabic Toxicology*.

This text, in Persian,[1] is very helpful in regard to Persian names. There are 584 entries with a paragraph devoted to each one, in alphabetical order.

Abū Bakr Ḥāmid b. Samajūn of Spain flourished in the time of the famous Almanzor, the Ḥājib al-Manṣūr Muḥammad b. Abī 'Amir (d. 1002). His famous book, "The Collection of Statements by Ancient and Modern Physicians and Philosophers on the Simple Remedies,[2]" had been much quoted by al-Ghāfiqi and ibn al-Baiṭār but considered lost. Paul Kahle discussed the finding and contents of this previously lost work.[3] The treatise, alphabetically arranged, consists of citations from older sources in addition to the most quoted Dioscorides and Galen.

Kahle,[4] when he edited the section on mandrake, found, in the quotations from al-Dīnawarī, Dioscorides, Isḥāq al-Isrā'īlī, Galen, Paulus of Aegina, Māsarjawaih, al-Rāzī, and Oribasius, many synonyms in their ancient contexts.[5]

Abū al-Ṣalt Umaiya (d. 1134) of Egypt and Tunisia wrote on the simples; his work is often quoted. His book called *Al-adwiya al-mufrada* is ordered according to parts of the body and then arranged by similar ailments.

Maimonides was born in Spain, later moved to North Africa, and finally to Egypt because of religious persecution. An important work of his, "Explanation of drug names,[6]" is a glossary of 403 items of

[1] R. Seligmann, *Codex Vindobonensis sive Medici Abu Mansur Muwaffak bin ali Heratensis Liber Fundamentorum Pharmacologiae*, Pars I (Vienna, 1859); Romeo Seligmann, *Liber Fundamentorum Pharmacologiae Auctore Abu Mansur Mowafik ben Ali al-Herui.*, Epitome (Vindobonae, 1830).

[2] *Al-jāmi' l'aqwāl al-qidma' wa'l-mutahaddathīn min al-aṭibba wa'l-mutafalsafīn fi'l-adwiya al-mufrada.*

[3] Paul Kahle, "Ibn Samajūn und sein Drogenbuch," in *Documenta Islamica Inedita* (Berlin, 1952) pp. 25-44. Important MSS have been located in Oxford Bodleian 47, 48, a total of four volumes. A fragment is in British Museum Or. 11614.

[4] *Ibid.*, pp. 33-44.

[5] Much of this text found its way into ibn al-Baiṭār's book *Jāmi' mufradāt al-adwiya wa'l-aghdhiya*, translated by L. Leclerc, already cited as *Notices et Extraits..., 23, 25, 26.* The influence of ibn Samajūn 's method of discussing pharmacological materials has not as yet been completely assessed. It is known, however, from the later quotations of his work that he had much to do with the writings of al-Ghāfiqī and ibn al-Baiṭār, two of the best in the field.

[6] *Sharḥ asmā' al-'uqqar.*

materia medica; it gives their synonyms in a number of languages, Arabic, classical Greek, Persian, Syriac, Spanish (Andalusian and Old Castilian), and Berber. Significantly, Hebrew and the old Aramic names are not included.[1] Those simples which Maimonides considered very common and did not require synonyms are also omitted; thus camphor, ambergris, musk, violet, and others are not included.

The Arabic and Berber names are the popular ones. Maimonides was not an expert in Indo-European languages so that his Persian and Greek show some confusion in the names for simples; interchange of these synonyms and incorrect transcriptions may be found in the text. On the other hand, the Andalusian names of simples are of great value in that they contribute to the knowledge of a language which exists only in some rare manuscripts.[2] To some extent, the terms noted as Egyptian are vocalized as they are in present day Coptic. Further, the Berber conforms with the pronunciation given in the *Tuhfat al-aḥbāb.*[3] The Arabic and Syriac are generally correct.[4]

In regard to the influences upon Maimonides by other synonymatic texts or treatises which contained synonyms. there are five in number which should be mentioned. Actually, Maimonides himself is the source for this information. The first is by ibn Juljul of Spain, called "The Explanation of the Names of Simple Remedies of the Book of Dioscorides," composed in 982/3 A.D. This work is no longer extant but is known by many allusions to it and quotations of it in the literature. Ibn Wāfid (b. 999- d. after 1065) wrote "Simple drugs[5]" extant now only in fragment form in Arabic but in its entirety in Hebrew and Latin translations (the Latin is by Gerard of Cremona as *Liber de medicamentis simplicibus Abenguefith*, printed in Strasbourg, 1531).

[1] The reason for this is unknown. I. Loew, *Die Flora der Juden* vol. iv. p. 75. He did, however, know the Hebrew as shown by Loew.

[2] For the transcription into Arabic, *cf.*, F.J. Simonet, *Glosario de voces ibéricas y latinas usadas entre los Mózarabes* (Madrid, 1888); *cf.* also R. Dozy and W.H. Engelmann, *Glossaire des mots espagnols et portugais dérivés de l'arabe* (Leyde, 1881).

[3] A Moroccan text whose author and date are unknown. It is probably from about 1700 or a little earlier; it was edited and given in French by H.P.J. Renaud and G.S. Colin (Paris, 1934).

[4] I. Friedländer, *Der Sprachgebrauch des Maimonides. Ein lexikalischer und grammatischer Beitrag zur Kenntnis des Mittelarabischen, I, Lexikalischer Teil* (Frankfurt/M, 1902).

[5] *Al-adwiya al-mufrada.* Bockelmann, I, p. 485.

Third, al-Ghāfiqī's "Book of Simples" was highly respected by Maimonides. Ibn Samajūn also was considered by Maimonides as a man of learning for his "Book of Simples." Finally, there is ibn Janāḥ (b. *ca.* 990) whose *Talkhīṣ*, "Précis," is lost but is known from citations by al-Ghāfiqī, ibn al-Baiṭār and ibn al-Suwaidī (end of the 13th cent.). Most of the pharmacological material in Maimonides' book, therefore, is of western origin although it is known that it was written in Egypt.[1] Ibn Biklārish of the Maghrib, a contemporary of Maimonides, was not known to him. The former's work will be described later.

Every simple has its own numbered paragraph which may be only one word or a page in length. From the text are the following :

"43. *Bunduq* is the *jillauz* [2]

"95. *Dār ṣīnī* is Chinese cinnamon and not *al-qirfa*. I state this because the Egyptians call *al-qirfa dār ṣīnī*. Some say the *dār ṣīnī* is the *dār sūs*, and some *al-qirfa*.[3]

"94. *Dūqū*. Most commentators have stated that it is the seed of the wild carrot *(al-jazzar al-barrī)*. According to Galen's works on compound remedies, 'the seeds of the wild carrot and *dūqū* are identical.' Some have said that it is the seed of another species of carrot of *al-aḥilla*. This plant is used to make toothpicks; it is well known in the West as *al-muntina* [the fetid] and is burned in the furnace.[4]"

Maimonides' alphabetical glossary of synonyms of drugs, as he states in his introduction, is not to describe the simples or their uses but only to identify their various names. In his introduction, he declares that no mention is to be made of such popular remedies as

[1] Maimonides, glossary, p. lxiii.

[2] Maimonides, p. 8 (Arabic). *Bunduq* comes from Greek *pantikòn káryan*, "Pontic nut." Its synonym, *jillauz*, is from Persian *galūz* or *jalūz* from *chilghuza*, "forty nuts." This denotes the pine or fir tree and their fruit.

[3] Maimonides, p. 13 (Arabic). *Al-qirfah* is "bark." The different species of cinnamon tree were not distinguishable in the Arabic period or in any time before or after. Many believe that the Greeks knew the bark of *Cinnamomum aromaticum* Nees, *dār ṣīnī* "Chinese cinnamon," as having come from China. *Dār sūs* and *qirfa* were names used for inferior species. Today, *dār ṣīnī* is the *salīkha* (Ducros, 127); *cf. al-Samarqandī* pp. 194-195.

[4] Maimonides, p. 13 (Arabic), pp. 49, 50. The Greek *daũkos* has *dūqū* or *dawqū* as its genitive and means carrot. *Dūqū* in Arabic refers only to carrot seeds. It was known to the Arabic writers through Dioscorides. *Jazar barrī*, "wild carrot," refers only to the plant. The word *muntin* is a popular word simply indicating that the seeds are odoriferous. Today, only the cultivated carrot seed is sold in Cairo.

the fig, raisin, and similar fruits which have a great many synonyms. He also states that it is his intention to keep the treatise as small as possible for easy use. Always, where there is disagreement, the more preponderant opinion is given, and in the case of Berber names, only the most generally accepted and reputed terms are mentioned.[1]

Another synonymatic text [2] (of 1700) *in abjad* order, *i.e.* of the old Semitic alphabet, which should be discussed at this point, since Meyerhof in his work on Maimonides' synonymatic text derived much of his information from it, is "A precious gift to friends on the attributes of plants and herbs." A glossary of 462 Moroccan simples by an unknown author, it contains material from the botanical, mineralogical, and zoological kingdoms.[3] The author seems to have been a native of Marrakesh and so the text is rich in Berber terminology.

This *Tuḥfa* whose origin is highly uncertain, therefore, may have been simply a section of a larger treatise on medicine. Such, for example, is the *Tafsīr al-asmā'*, the twenty-ninth book of the great work of al-Zahrāwī.

Brief synonymatic texts such as the *Tuḥfa* and that by Maimonides were written for good reason. Pharmacology, particularly when read by a foreign speaking people, has a great number of terms which require explanation. These outnumber, for example, the terms in anatomy or those for the names of diseases. Not only is this true for the quantity but the difficulty in understanding the names of simples is much greater and particularly more hazardous. The latter is true since many of the simples, to the Berbers, were from very distant regions and were unknownin Morocco. This kind of treatise is particularly useful to apothecaries, merchants, herborists, and physicians or healers.

The *Tuḥfa* is much more abbreviated than the Maimonides book above described. Examples from the former follow :

"177. *Ḥanzal* is called *al-ḥedj*, and in Berber, *taferzīzt*."

"In one text it is *tafersīt*. *Ḥanzal* is the colophony or *kolokynthís*

[1] Maimonides, pp. 3-4 (Arabic).

[2] This work is not discussed in chronological order since it is desired to demonstrate its relation at this point to the Maimonides text previously described.

[3] Library of Algiers 1031 at the time when H.P.J. Renaud and G.S. Colin worked on the text. It has since disappeared but was published by these scholars in Paris, 1934. Its title is *Tuḥfat al-aḥbāb fī māhīyāt al-nabāt wa'l-a'shāb*.

[Greek] of Dioscorides. It is probably the *Citrullus colocynthis* Schr. The popular name in ibn Biklārish is *ḥidj* but now is *ḥedj*. *Taferzīzt* may also be *taferzīst*, *aferzīz*. and *tiferzīzt*,[1]" according to Renaud and Colin.

"301. *'Aqirqarḥā* is *tigenṭast* in the popular language."

One manuscript gives *taganṭist* as a variation. This is pyrethrum. The former word was originally Aramaic, according to Dozy. It corresponds to *púrethron* (Greek) of Dioscorides but the ancient descriptions show that it is not *Anacyclus pyrethrum* L. However, *tigenṭast* of the Berbers does correspond to it. There are many dialectal variants as *tāghendest*, *tīghenṭast*, and other. This word indicates the root of pyrethrum of Africa which is sold by all Moroccan apothecaries.[2]

Another entry in the *Tuḥfa* reads :

"'*Ūd* has thirteen kinds. Its best is the Indian, then comes the *samandūrī*, then the *'ūd Qumārī*, the black, which sinks in water.[3]"

'Ūd is aloeswood and known to Dioscorides [4] as *agálochon* (Greek) usually identified as either *Aquilaria malaccensis* Lamk, or A. *Agallocha* Roxb., Indian trees. The Tamil is *agalichandana*. In Hebrew, it is *ahālīm* and *ahālōt*. The Sanskrit *agāru* gives rise to the Greek and to the Persian *anjūj* and *alanjūj*. *'Ūd* means "wood" and, extended, is "fragrant wood," applying fully to aloe. The *samandūrī* is also called *mandālī*.

Al-Ghāfiqī, who wrote "Book of Simple Drugs,"[5] lived near Cordova. In his time, he was the greatest authority on pharmacology. His procedure in this book was to abridge the writings of Dioscorides and Galen, and then give statements of later pharmacologists on a drug. Meyerhof has declared that "ibn al-Baiṭār's pharmacology is nothing more than al-Ghāfiqī's book with some enlargements and commentaries." Ibn abī Uṣaibi'a wrote that ibn al-Baiṭār always took with him, on his voyages, the "Materia Medica" of Dioscorides, and Galen, and the drug book of al-Ghāfiqī.[6]"

[1] *Cf. Tuḥfat al-aḥbāb*, pp. 19 Arabic, 80 French.

[2] *Cf. Ibid.*, pp. 31, 134 French.

[3] *Ibid.*, pp. 136-7 French; p. 32 Arabic.

[4] Dioscorides, Book I, p. 22.

[5] *Kitāb al-asdwiya al-mufrada.*

[6] M. Meyerhof and G. Sobhy, *The Abridged Version of "The Book of Simple Drugs" of... al-Ghāfiqī by... Barhebraeus* part 1, p. 33. Full text of the first half is in Osler Library, Montreal.

Although this al-Ghāfiqī text has already been described under another heading, its importance for its contents of synonyms has not been pointed out. A good example from this text is :

"35. *Ushshaq* [gum-ammoniac]. It is also called *ushshag*, *washshag*, and *washshaq*.

"Dioscorides III. *Ammōniakón* [in Greek] is the gum of a plant resembling in shape the galban-ferula *[kalakh]*. It grows in the land of Libya, further inland than Cyrene. The shrub is called *agasyllís* [Greek]. The choicest is that which has a beautiful color, free from stones and wood, whose particles resemble a lump of frankincense as to purity and density, the odor of which is that of castor and the flower of which is bitter. The kind containing dust and stones is called "mixed." It is brought from a place called Ammon, and is the juice of a shrub resembling the galban-ferula.

"Galen VI. Its gum flows out of a straight stem. Its faculty is laxative; it heals induration of the spleen and resolves scrofulous glands."

Gum-ammoniac came to the Greeks from the Persians. Al-Bīrūnī states that the first Arabic-writing authors called the poppy and other plants *ushshaq*. The Arabic names are the same as the Persian. Another Persian name is *bilshir*.[1]

Another simple is described as follows :

"157. *Bantūma* [mistletoe]. This plant is known in our land [Spain] under this name, and is also known as *al-raq'a al-fārisiyya* [Persian shift] and *dharq al-ṭair* [bird's dung]; it is also called *al-kharaftān* and in Syriac *mārāqūnā*...[2]"

A final quotation from al-Ghāfiqī will serve to demonstrate the great value of his text :

"*Hindabā'* [chicory, endive]. Dioscorides II. *Seridos* [in Greek] is of two kinds. In shape, one resembles lettuce with broad leaves and the other has narrower leaves and is bitter. A wild kind is called *kichórion* [in Greek] and has leaves broader than those of the cultivated kind.

"Ibn Samajūn. The cultivated kind is of two species. One has long leaves, blue flowers, a nauseating taste and is bitter particularly at the end of the summer when it yields young twigs. Of this kind is a

[1] *Ibid.*, pp. 116-118.

[2] *Ibid.*, part 2, p. 331. Almost exactly the text in the original al-Ghāfiqī treatise in MS Montreal Osler, 7508.

wild type which resembles it in form and flowers except that it is more bitter and distasteful. It is called *amīrūn*. The other type has broader leaves, white flowers, and is tasteless, especially in the first part of spring. In the Roman language it is called *antūbiyā;* this is the Syrian. The Hashimite is close to it as to the form of its leaves and its slight bitterness but different in the form of its flowers and the abundance of its down. It is called in the [Spanish] dialect *al-sharrālīya;* it is said to be *al-tarakhshaqūq*."

"The author says,... There exist two other kinds of the wild type. One is *al-ya'dīd*, called *chondrille* in Greek. [Here follows descriptions by Galen, Dioscorides, al-Masīḥī, al-Rāzī, al-Isrā'īlī, ibn Māsa, al-Basrū, al-Ṭabarī, ibn Kāsa, ibn 'Imrān, and more by al-Rāzī.[1]"]

The Syriac *antūbiyā* gave rise to the Arabic *hindabā'* and to the mutilated Greek *īntybos* and Latin endivia. The cultivated, broad-leaved kind is the endive *(séris* in Greek); the narrow type is the *kikhórion* (Greek) or chicory. The Arabs called the chicory *'alath;* in Hebrew it is *'ulshīn*. The *amarum* of ibn Samajūn is the chicory. *Tarakhshaqūq* is from the Persian *ṭalkh shukīy*, originally (bitter purslane)[2].

It must be remembered that these examples have been taken from an abridgement of al-Ghāfiqī's work. Since part of the original al-Ghāfiqī work has come to light, it is now known that it included many botanical and philological data especially the synonyms in Spanish and Oriental languages.

Al-Idrīsī (1100-1166) wrote one of the best botanico-pharmacological works of his time. A good part of his work was carried out from his own travels as a geographer and as a botanist. He finally settled in Sicily at the court of King Roger II. His pharmacology begins with a botanical section. It is called "Universal Collection.[3]"

An extract will show al-Idrīsī's interest in language.

"*Aruz [riz]*. This is the seed of a plant mentioned by Dioscorides in the second book and which he calls *óryza*. In India, it is called *riza*, in Arabic, *uruzz*, in Persian *birinj*, in Syriac *aruzzā*, in Turkish *tuturgbān*, in Berber *āsankār*, in Indian *qandūl*, in Kurdish *ibrinj*, in French *rūs*, in Hebrew *ōrez*, and in modern Greek *rýza*. It is a known

[1] *Ibid.*, part 4, pp. 544-546.

[2] *Ibid.*, pp. 546 ff.

[3] *Kitāb al-jāmi'*. Only half of it is extant, now in MS Istanbul Fatih 3610.

plant which resembles the barley plant except that its cluster is broken up like that of Yemenite barley *[Hordeum pallidum* Sér.]. It is cultivated for its grain. It is cold and dry, has a slightly astringent taste. For this reason it is moderately constipating and salutary for ulceration of the intestines which are compressed.[1]"

Al-Idrīsī knew the Mediterranean countries well.

Ibn Biklārish, a physician of Spain of the latter part of the eleventh century, wrote one of the greatest pharmacological treatises of all time.[2] The title refers to al-Musta'īn, the fourth king of Saragossa of the *Banū Hūd* dynasty; he died in 1110. The text is in the form of synoptic tables, a literary form deemed necessary at this time because of the overwhelming amount of data which was available and had to be condensed for quick reading.[3] Other types of tables were also prepared for students of anatomical terms and diseases.

One of the best known in the Middle Ages was the *Tacuini Sanitatis Eluchasem Elimithar medici de Baldath* [4] from the Arabic *Taqwīm al-ṣiḥḥa*,[5] *Tabula sanitatis*, of ibn Butlān (d. 1068), a Baghdad physician. This text is written in the form of a table giving, in an orderly, easily found system, facts about drugs, foods, exercise, and other health factors. In the same manner, abū al-Fidā' [6] (d. 1331) wrote his geographic text, *Taqwīm al-buldān*, "Table of Countries," and ibn Jazlā (d. 1100) set up his *Taqwīm al-abdān fī tadbīr al-insān*,[7] "Table of bodies with regard to their constitutions.[8]" on therapy, prognosis, and various diseases *a capite ad calcem*.

[1] This quotation is from Max Meyerhof, *Al-Andalus 3*, 24 (1935).

[2] *Musta'īnī fī al-ṭibb; cf.* M. Levey, and S. Souryal in *Janus* (1968).

[3] H.P.J. Renaud, *Hespéris 10*, 135-150 (1930); also *VIe Cong. Int. Hist.* (Leyde-Amsterdam, 1927) pp. 267-273).

[4] (Strasbourg, 1531).

[5] MS Paris Bib. Nat. 2945, 2947; British Museum 441, Suppl. 792/3. See L. Thorndike and G. Sarton in *Isis 10*, 489-493 (1928).

[6] MS Leiden 802, published by I.B. Koehler (Lipsiae, 1766), and others.

[7] MS Paris 2947/52, Bodl. I. 549.

[8] In Latin, *Tacuini aegritudinum cet. Buhahylyha byngezla autore* (Argentorati, 1582).

It is true that the strength of barberry is similar to that of pear; besides its contracting strength it has a mild constipating effect. If eaten or taken as a juice it checks and stops dyscrasia of the humors. Its tree is known as the sharp thorn and it resembles a wild pear tree. Acacia may be washed and used as an eye drug. It is pulverized with water and the excess water is poured out gradually until

Drugs	Humor and degree	Synonyms in Other Languages	Substitute
Barberry [1]	Cold and dry in 2nd degree	It is *shararchak*, and *al-shirīsh* with a Persianized *shīn*. It is [also] called *barbarīs* and *ozbaīs*. It is said to be *athwār*. *Abū Ḥanīfa* :[2] It is *al-barbarik*. In Persian it is *zarashk* or *atrāda*. In Berber it is *arghiz* without a *lām*.	Its weight of rose seed and 1/3 its weight of sandalwood.
Acacia [3]	Cold and dry in 1st degree	It is *rab-al-qaraṭ* with the vowel [mark] a on the *qāf* and with a Persianized *ṭ*. *Qaraṭ* is the *al-shauka al-miṣriyya* ("Egyptian spine") as it grows in Egypt. It is the *saqrīd* and *niyūn*. It is also called the *umm ghailān* tree.	Its weight of *rāk* (?) or lentils and sandalwood in halves.
Feverfew [4]	Hot and dry in 1st [degree]	It is known in Persian as *ghashūnis*. In the language of Saragossa, it is *bablinaira*. There are two kinds, yellow and white. The white is called *amārīqūn*, the yellow *amārīkūn*. Abū Hanīfa : The singular is *uqḥuwana* and the plural is *al-uqāḥī* with the *tashdīd* and the *takhfīf*. It is called *al-uqḥuwān* but *al-quḥwān* if it follows *alif* and *lām*.	Its weight of camomile.

[1] *Ambarbāris* is synonymous with the Pers. and Syriac *zirishk* and *mūbarij*, *Berberis vulgaris* L. The Berber name for bark of the root is *ārghīs* (I.B. 4) Turk.is *qadīn tuzluglu*. An Ar. synonym is *'ūd al-rīḥ* (al-Ghāfiqī 15). See I. Loew, *Aramaeische Pflanzennamen* (Leipzig, 1881) pp. 139-140, I. Loew, *Die Flora der Juden*, I 287 ff. Aḥmed Issa Bey, *Dictionnaire des noms des plantes en latin, français, anglais, et arabe* (Le Caire, 1930). pp. 30-18, M. Levey, *al-Samarqandī*, 238.

[2] Abū Ḥanīfa al-Dinawarī (d. 895) wrote *Kitāb al-nabāt*, "Book on plants," which is lost but is known from numerous quotations. This book was the main authority for plant names (al-Ghāfiqī, p. 16).

[3] *Aqāqiyā* is the juice of *Acacia arabica* Willd. *var. nilotica* Del. Dioscorides (I, 101) calls it *akakía*. The fruit in Ar. is *qaraḍ* (Levey al-Kindī, 234). It is also called *al-shauka al-'arabiyya, aghailān*, (Loew *Aramaeische Pflanzennamen*, 197) *sant* (related to hiero.

the water is clear. It is made into tablets. It may also be heated on fire and blown on, or perhaps burnt in an earthen pot. Feverfew has strength [like] that of spurge in regard to its opening and dissolving powers. Yet, it is hotter than it.

Usefulness, Qualities, and Methods of Use
If taken as a liquid dose or eaten it stops acute diarrhea and acute dyscrasia of humors of the uterus. It prevents thirst caused by heat. It strengthens the liver and the stomach. It is good in poultices and contracts if applied to acute swellings. If applied on the belly of a pregnant woman it is said to cause abortion. Its strength is similar to that of the pear. Besides having contracting strength it has a mild constipating effect. If eaten or taken as a juice it checks and stops dyscrasia of humors. Its tree is known as the "sharp thorn" and it resembles a wild pear tree.
Acacia has a contracting, cooling effect. It is good as an ophthalmic drug, for erysipelas, whitlows, and mouth ulcers. It is useful in cases of exophthalmos; it stops the running of fluids from the uterus. It is useful in cases of odor of the anus and uterus, constipation of bowels, and blackening of the hair. One may wash with it and use it as an eye drug. It is pulverized with water; then the excess water is poured out gradually until the water is clear. It is then made into tablets. It may also be heated on fire and blown on while it burns in an earthen pot in an oven.
If taken dry with oxymel and some salt it evacuates phlegm and black bile. It is good for those who complain of asthma or black bile. If the plant without blossoms is taken as a drink it cures fever and asthma. Women sit in its water to develop a stronger uterus and to diminish an accidental, inflamed swelling in them. With its blossoms it is good as a poultice to cure erysipelas and inflamed swellings It resembles camomile in having some similar power to open obstructions and to dissolve [the humors] but in a smaller proportion.

Egypt. *šndt*, Coptic *šonte* and Heb. *šiṭṭa*. See ibn Baiṭār, Leclerc ed. 1758. *Tuḥfat al aḥbāb*, 46 gives a synonym for the tree as *al-ṭalḥ*. It is *AḪR* in Sumerian and *kiškanū* in Akkadian. See Loew *Flora*, 377-391, Issa, *op. cit.*, 2, 3.

[4] *Uqḥuwān* is probably *Chrysanthemum parthenium* Pers. (al-Ghāfiqī 48). The Spanish names are *manzanilla, poplinaira*, and *guijones*. The Persian is *ākaḥwān* (J.A. Vullers, *Lexicon persico-latinum etymologicum* (Bonnal, 1855-67) 113). *Ghashūnis* is related to Sp. *guijones* and *bablinaira* to *poplinaira*. The identification of this plant is in some doubt (Ibn Baiṭār Leclerc ed., 121). It is the camomile *(bābūnaj)* to the Arabs; in Egypt it is known as *kirkāsh*. Dioscorides (III, 138) has *parthénion* in an oxyme used for asthma and discharge of phlegm and black bile. The Berber is *ālūshan* and the Persian *kāfūrī*. See al-Ghāfiqī 48, Levey al-Samarqandī 230.

Savin [1]	Hot and dry in 3rd degree	It is said to be male *('ar'ar)* juniper; also it is said to be seed of *difrār*.	Its weight of Chinese cinnamon.
Nettle [2]	Hot and dry in 2nd degree	There are two kinds, *al-ḥurraīq* and *al-qurraīs; al-ḥurraīq* is coarse, blacker, with wider leaves and is called *al-wāliah nāghra* which is interpreted as the black eye. The second kind is known in Persian as *artīqīn* which is also called the eye of the snake.	Seed of onion
Asafetida [3]	Hot and dry in 3rd degree	It is a tree whose leaves are called *anjudān*. Its gum is called *ḥiltīt*. The root is *mahrūth*. I saw that *anjudān* is the bad smelling fruit of *ḥiltīt*. It is also called *musfastīn*.	Two thirds of its weight of *ḥiltīt* and its weight of parsnips (?).

Savin is found in two kinds. One has leaves similar to those of the palm bough and odorless; the other has a detestable odor... Savin has the power to peel scabs on the skin due to fire. If taken it assists bleeding because of its mildness; that is how it causes miscarriages. Nettle is very mild and, therefore,

[1] *Abhul* is *Juniperus sabina* L. *Difarār* (Persian) is from Sans. *dēva dāru* which means "tree of God," or *shajarat Allāh* in Arabic. A synonym is *barāthwā* from Syriac *barūthā* from Gr. *bráthy*. *Cf.* Loew, *Aramaeische Pflanzennamen* 64, Maimonides 22, *Tuḥfat al-aḥbāb* 26, *(abhal ubhul, ibhil)*. Akkadian *liāru* "white cedar" probably is cognate to Ar. *'ar'ar* (R. Campbell Thompson, *A Dictionary of Assyrian Botany*, pp. 271, 285). Akkadian *qaṭranu* = Ar. *qaṭirān*, a resin from the *abhul* tree.

[2] *Anjura* is Roman nettle, *Urtica pilulifera* L. most of the time, and sometimes the small nettle, *U. urens* L. In the Maghrib, it is *al-ḥurraīq*, "the burner," in Old Spanish *anīfis*, Sp. *ortiga* from *arthalīqā*. It is also known in Ar. as *nabāt al-nār* "plant of fire." *Ḥurraīq* and *qurraīs* also refer to burning or stinging. Persian is *gazna* and Turk. *isirghān*. *Cf.* al-Ghāfiqī 741, Maimonides 14.

As the third, its element is very mild. It removes smelly, serious, chronic ulcers. If used with honey it cleanses blackened dirty ulcers, and increases more than anything else the flow of menstrual secretions. It nourishes living embryos and brings out the dead ones. If used as a poultice, it cleanses the blemishes of skin. It may be used as an incense [for women] to cause miscarriage which is probable. Savin is of two kinds; one has leaves analogous to that of the palm-bough, odorless; the other has a bad odor. Savin has the power to peel off fire scabs on the skin.[4] If taken it assists bleeding because of its mildness; that is how it causes miscarriage.

If the leaves of any of the two kinds are pounded and used with salt as a poultice it cures cancerous ulcers, filthy ulcers, nerve pain, abcesses and accidental swellings in the root of the eye.[5] If it is with ceruse as a poultice it could be used for an enlarged spleen. If the leaves are pounded and applied to the nostrils, it stops bleeding of the nose. If carried with a sour-sweet it makes the menses flow. If the leaves are burnt while green and applied to a leaning uterus, it restores it [to its position]. If taken as a drink with a sour-sweet it makes the menses flow. Nettle is very mild; therefore it affects all the organs it meets; it especially excites lust for sexual intercourse if it is eaten with onions and egg yolks.

If eaten with oxymel it cures pain in the trachea and aphonia. It could be eaten with bread instead of rocket leaves. If pounded, squeezed and added to honey it generates moisture for swelling of the uvula. One gargles with it in case of tonsil [inflammation]. If added to eggs it is good for coughing. As a mouthwash it is good for toothache and deterioration of the gums. If added to vinegar it causes acridity which cools the humors and stops [excess] waste. It is good as a remedy for the eyes. It helps belching and digestion of heavy food. It disintegrates a bad tooth. It is harmful to the stomach and the liver.

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it affects all the organs it meets. It especially excites lust for sexual intercourse if it is eaten with onion and egg yolks. Asafetida has the power to disintegrate a bad tooth. Also, it is harmful to the stomach and the liver.

[3] *Anjudān* is *Ferula asafetida* L. Synonyms are *ḥiltīt* (the resin, *Tuḥfat al-aḥbāb* 169) and *usturghāz* (the root, from Pers. *shuturghāz)*. Dioscorides (III 80) employed asafetida, *silphion*, for the stomach, lungs, teeth, eyes, coughs, etc. In Sumerian, it is *AŠ*, in Akkadian *ḫatti re'i* (R.C. Thompson, *op. cit.*, p. 355). *Cf.* Levey, al-Kindī 260, Loew *Flora*, III, 452-5. *Anjudān* is from Pers. *angudān* or *anguyān* and Sans. *hingu* (Maimonides, 18). According to al-Ghāfiqī 34, *mahrūth* is the root (after ibn 'Imrān) or *mahrūt* (after al-Rāzī). In Gr. the leaves are called *máspeta* (Dioscorides III 80) which gives *musfastīn* of the text.

[4] *Ḥashkarīsha al-nār* in R. Dozy, *Supplément aux Dictionnaires Arabes* I, p. 291 (after ibn al-Baiṭār).

[5] *Apex orbitae* in Ḥunain's *Ten Treatises*, 173.

The tables of ibn Biklārish contain all the important information about a drug a physician may wish to prescribe.[1] In his text, the reverse of one folio and the observe of the following folio, *i.e.* the two pages facing each other, make up each of the large, multicolumn tables. The following information is given for the drugs whose names are written in a vertical column : Galenic nature and grade, synonyms in Persian, Syriac, Greek, Latin, and Old Spanish, a substitute drug, preparation, therapeutic value, and uses of the drug. A typical set of facing pages from the ibn Biklārish text translated into English follows. The order of the table is given from left to right instead of the reverse.[2]

In regard to other literary models. not only did the Muslims systematize the pharmacological knowledge of the Greeks, Indians, Persians, and Babylonians but in many highly specialized smaller treatises, they made genuinely original contributions to enhance knowledge of the medieval materia medica. One of the earliest in the Arabic world to write such a treatise on pharmacology was abū Zakarīyā' Yūḥannā ibn Māsawaih. He was later called Mesue Senior, and in the Renaissance, Johannes Damascenus.[3] Ibn Māsawaih was the last great physician of the ancient medical school at Jundīshāpūr. Ibn Māsawaih's text discussed here was one of forty-four works of his, most of them on medicine.[4]

It is not too suprising that ibn Māsawaih devoted a treatise to the subject of odoriferous materials in pharmacology. From very early times, in Sumer, aromatic materials had been procured by distillation and used medicinally.[5] The importance of these aromatic simples as the basic elements in the most ancient drug and medical treatises seems not to have diminished during the Muslim period.

The work of ibn Māsawaih is interesting in that it gives what were considered the most important aromatics of the time. Described briefly are the pharmacological properties of most of them, and their favorable and unfavorable qualities. Particularly of note for the history of

[1] MS Leiden 1339 and MS Rabat 481 were used by this author. *Cf.* also H.P.J. Renaud, *Bull. Soc. franc. Hist. Méd. 21*, 345 (1927).

[2] Pages 23-24 of ibn Biklārish, MS Leiden Cod. Or. 15.

[3] *Cf.* L. Leclerc, *Histoire...* vol. I, pp. 103-104.

[4] Text ed. by P. Sbath. *Bull. de l'Inst. d'Égypte*, ser. VI, *19*, 5-27 (1937). Transl. and commentary by M. Levey, *Journal Hist. Med. 16*, 394-410 (1961). The small treatise is "On Simple Aromatic Substances," *Kitāb jawāhir al-ṭibb al-mufrada.*

[5] M. Levey, *Chemistry and Chemical Technology in Ancient Mesopotamia*, chapters 4, 11.

pharmacology in the early ninth century are the distant regions from which the simples were brought, as India, Tibet, Jiddah, Yemen, Syria, Adharbaijān, Andalusia, Persia, Iraq, China, and the East of Middle Africa.[1]

The aromatics in this small treatise are to be found in the Greek, Indian, and Babylonian pharmacopoeias with the possible exception of a very few whose identification is still uncertain. It was not unusual in medieval Arabic times to write up the preparations or lists of aromatic substances in treatise form since this had been done not only by Dioscorides but also in India and in Babylonia.[2]

Some of the later Arabic writings on the subject seem to have copied the material word for word, either from ibn Māsawaih or from a common source. These include such well-known authors in pharmacology and botany as abū al-Qāsim al-Zahrāwī, al-Tamīnī (end of 10th cent.), Aḥmad ibn abī Ya'qūb (d. 995), and others.

It may be noted that the actual winning and final preparation is not discussed. They were brought by merchants to the Greeks and Arabs in a dried or concentrated state to be worked on by the pharmacist-physician. This is shown in a work by ibn Māsawaih.

In the treatise, there are principal and secondary aromatics.[3] The former number five : musk, ambergris, aloe, camphor and saffron, and the latter include nard, clove, sandal, nutmeg, fennel, rose, *falanjah*,[4] *zarnab*, cinnamon, Indian pepper, cardomom, cubeb, small cardomom, seed of *mīsum*,[5] Indian lotus, mahaleb, *wars*,[6] costus, ungues odorati, *bunk*, lentisk, laudanum, storax, and kamala.[7]

[1] *Cf.* also A. Schmidt, *Drogen und Drogenhandel im Altertum* (Leipzig, 1924).

[2] *Cf.* P. Ray, *History of Chemistry in Ancient and Medieval India* (Calcutta, 1956) pp. 236-238; E. Ebeling, *Orientalia 17*, 129-143, 299-313; *18*, 404-418; *19*, 265-278 (1948-1950); M. Levey, *Chemistry and Chemical Technology in Ancient Mesopotamia.*

[3] This early Arabic division of aromatics into principal and secondary ones is about a century before al-Mas'ūdī's *Murūj al-dhabab wa'ma'ādin al-jawāhir.* "Meadows of Gold and Mines of Precious Stones," ed. by C.B. de Meynard and P. de Courteille (Paris, 1861-1877) 9 vols., vol. 1, p. 367. He gives the same principal aromatics and his secondary ones are cardamom, cubeb, seed of carpobalsam, zanthoxylin, mahaleb, *wars*, costus, *azfār*, *burank*, lentisk, *lādan*, storax, *kamala*, *dharira* and *zibeth.*

[4] This may be a fern after the Spanish *falaja* = *helecho.*

[5] Possibly bark of the *Acacia nilotica.*

[6] Perhaps *Flemmingia rhodocarpa* Bak.

[7] *Rottlera tinctoria* Roxb., a purgative and anthelmintic.

Many new technical words, some still unidentified are to be found in ibn Māsawaih's treatise. The following short quotations will serve to explain his method of writing his book.

"Camphor [1]

"There are various types, one of which is *zabajī* its best. It is white resembling salt. Then there is the *sarbuwī* which is next in quality. Then, there is the *dumūb*, then the *irār*, then the *isfaril*, then the *naḥt*. The *naḥt* may be mixed with *isfaril*. Another is the *muṣa'ad* [2] derived from all the camphors; it is not the original substance. All are brought from the land of Sofala in India.

"Camphor is a tree gum as related. Once there came down to the druggists of Basra a piece of wood of the camphor tree resembling the heavy wood of the *zanjīah* tree... They split it up and camphor scattered from it similar to white salt... The people of China and others use the wood in the fine arts..."

"Camphor is cold, dry, hot. It arrests many things, and it prevents wounds from stretching and then suppurating."

Two smaller descriptions from this treatise read :

"Cubeb [3]

"It is like pepper in appearance. It is inferior to cardamom and its odor resembles that of sisymbrium. It is introduced into liquid aromatics for women. It is brought from Sofala and is superior to cardamon in the warm nature.

[1] *Kāfūr. Cinnamomum camphora* and others. Only a few types are named here of more than a dozen known to the Arabs. There is not much known of their real differences. A Siggel, in *Das Buch der Gifte des Jabīr ibn Ḥayyān* p. 117, has "This is a cold dry plant which helps in hot ailments. If one takes a little in a cold mixture, it inactivates the genital organs, makes the nerves work, depresses the sense of taste, removes warmth from the heart, harms the digestion, tightes the breathing, affects the lungs, make one pale and changes the color and harms one very much..."

In India, it was prescribed for sprains and rheumatism. Internally, it is believed to shorten the cold stage of an intermittent fever and is highly useful in typhus (Ainslie, vol. 1., pp 48-51). Ibn Jazla called the types of camphor, *al-qaiṣūrī*, *al-riyāḥī*, *al-azādh*, and *asfarnak*. The latter must be sublimated from its wood; its tree is very large for it can shade more than 100 riders (E. Wiedmann, *Sitzungsber. d. Physik.-Med. Soz. in Erlangen 49*, 44-45 (1916).

[2] A distillation product.

[3] Used as a diuretic and to dissolve calculi. It has a bad effect on the alimentary tract (Achundow, *op. cit.*, pp. 99-100). In India it was and is used as a stomachic and carminative (Ainslie, vol. I, p. 98; al-Ghāfiqī, pp. 541-542).

"Small Cardamom [1]

"It is like the thin part of the crushed cardamom. Its odor is close to that of the cardamom. It is employed in perfume for women. It comes from Sofala and is stronger than cardamom and better than it for the stomach."

Another type of treatise is the technological work. One of these relating to the manufacture of perfumery products was written by Ya'qūb ibn Isḥāq al-Kindī, called, "Book on the Chemistry of Perfumes and Distillation.[2]"

The distillation to obtain essential oils is given in full with an elaboration of the method and parts of the apparatus including a diagram of it. The remainder of the book is concerned with recipes for aromatic preparations.

A typical recipe reads as follows :

"61. Preparation of another wonderful aromatic oil.

"You take one or two *raṭls* of the best jasmine oil, pour it into a glass bowl and pour on it for every mana of jasmine oil three *raṭls* of purified *naḍūḥ* [some kind of aromatic]. Then citron, apple peel, pieces of quince purified of the seeds, pulverized sandalwood, dry red roses, fresh myrtle tops, leaves of wild thyme, leaves of *Ocimum* dried or fresh, and pulp of the citron or its juice are added and it is covered, then stirred once every day. When you wish, you renew the ingredients every five days. It is very sharp and aromatic. Filter it into a flask and throw in two grains of musk. It will give you a wonderful aromatic.[3]"

Other works on technology have added much to our knowledge of Arabic pharmacology. A good example is a work on medieval Arabic bookmaking in which there are many recipes including botanicals used for inks and glues, methods of tanning and the manufacture of paper.[4] Another text on chemical technology in Arabic minting gives further properties of some of the pharmacological simples.[5] Many

[1] *Cf.* Maimonides, no. 116 for the synonym, *hāl*, *qāqulla*, *jar-bawwā*, *hāl-bawwā*, and *shamshīr*. *Buwwa* in Persian is "aroma"; *hāl* comes from *ēlā* in Sanskrit; M. Levey, *The Medical Formulary... of al-Kindī* p. 342.

[2] K. Garber, ed. and transl., *Kitāb kīmiyā' al-'iṭr wat-taṣ'īdāt* (Leipzig, 1948).

[3] *Op. cit.*, p. 40 (Arabic).

[4] M. Levey, *Medieval Arabic Bookmaking*.

[5] M. Levey, *Aspects of Medieval Arabic Minting* (in press).

more examples of this type of text have been cited in this work on medieval Arabic minting.

Further, contributing to and preserving the medieval knowledge of minerals and stones in pharmacology were the lapidaries and related treatises on mineralogy. One of the best known lapidaries in this period was the pseudo-Aristotelian treatise, *Kitāb al-aḥjār li-Aristātālīs* in the translation of Lūqā ibn Asrāfiyūn (or Bar Serapion, 8th or 9th cent.) from the Syriac. It is a mixture of Greek and Persian elements and is unlike the work of Theophrastus on this subject. The descriptions of stones are brief, giving their superstitious omens and pharmacological uses as well as physical properties.

"The stone onyx. There are more kinds of onyx. It is brought from the West. It is a stone which changes, being black and white yet not pitch black. It also occurs with a mixture of green and yellow. Whoever uses it as a seal has many worries and bad dreams. If it is hung on a child, then it becomes full of saliva. Whoever uses it as a vessel has no sleep. It is a very hard stone and its nature is cold and dry. If it is pulverized and the *yāqūt* stone is polished with it, then it makes it pretty and brings out its shine.[1]"

In the oldest Muslim lapidary extant,[2] by 'Uṭārid ibn Muḥammad al-Ḥāsib (9th cent.), the properties of precious stones are described. In fact, this work is quoted by al-Rāzī in his *Al-Ḥāwī*.

Ibn Sīnā, in his *Kitāb al-shifā'*, an encyclopedic work, devotes a section to mineralogy which includes stones and various chemicals.[3] A passage reads :

"Alum and sal-ammoniac belong to the family of salts, though sal-ammoniac possesses a fieriness in excess of its earthiness, and may therefore be completely sublimed. It consists of water combined with a hot smoke, very tenuous and excessively fiery, and has been coagulated by dryness.

"In the case of sulfur, their aquosity has suffered a vigorous leavening with earthiness and aeriness under the leavening action of heat, so far as to become oily in nature; subsequently it has been solidified by cold.

[1] J. Ruska, *Das Steinbuch des Aristoteles* (Heidelberg, 1912) p. 145.

[2] *Kitāb manāfi' al-aḥjār* or *Kitāb al-jawāhir wa'l-aḥjār*.

[3] E.J. Holmyard and D.C. Mandeville, *Avicennae de Congelatione et Conglutinatione Lapidum* being sections of the *Kitāb al-shifā'* pp. 36 ff.

"The vitriols[1] are composed of a salty principle, a sulfurous principle and stone, and contain the virtue of some of the fusible bodies [metals]. Those of them which resemble *qalqand*[2] and *qalqaṭār*[3] are formed from crude vitriols by partial solution, the salty constituent alone dissolving, together with whatever sulfureity there may be. Coagulation follows, after a virtue has been acquired from a metallic ore. Those that acquire the virtue of iron become red or yellow, *e.g. qalqaṭār*, while those which acquire the virtue of copper become green. It is for this reason that they are so easily prepared by means of this art."

The text then goes on with a description of mercury and its reactions.

Probably one of the more famous lapidaries is the "Book of the Flowers of Thought on Precious Stones,[4]" written in 1242. Its author was al-Tīfāshī (d. 1253).

The use of texts by the Arabs from all over the world, penetrating the far reaches from India to Spain brought with it a materia medica with even a greater geographical spread. In Arabic works, botanicals, for example, were used which came from as far away as China, Southeast Asia, the Himalayas, Southern India, Africa, and other faraway locations. In prescribing remedies, this very frequently made for difficulties. As a result another kind of pharmacological text arose, one which denotes the substitute drugs which may be used for those impossible to obtain or which are too expensive. These are the *abdāl* or drug substitute texts.

To denote the proper substitute drugs, Māsarjawaih wrote a treatise,

[1] *Cf.* E. Wiedemann, *op. cit., 43*, 97 (1911); M. Levey, *Medieval Arabic Bookmaking*, and *Chemistry and Chemical Technology in Ancient Mesopotamia* on vitriol.

[2] For *qalqand* or *qalqant* (from Gr. *chálkanthan)*, blue vitriol, *cf.* M. Levey, *Medieval Arabic Bookmaking*, p. 16.

[3] Probably a product of the calcination of blue vitriol. *Cf. ibid.*, p. 16.

[4] *Kitāb azhār al-afkār fī jawāhir al-aḥjār*. Al-Tīfāshī also wrote another work on minerals. It, however, never became well known. *Cf.* Brockelmann I, p. 652. There is an Italian edition of the "Book of Flowers" by Antonio Raineri, *Fior di pensieri sulle pietre preziose di Ahmed Teifascite* (Firenze, 1818). *Cf.* H. Ritter, J. Ruska, F. Sarre, and R. Winderlich, *Orientalische Steinbücher und Persische Fayence-Technik* (Istanbul, 1935). This book contains part of the text and translation of a ninth century lapidary by Muḥammad ibn Manṣūr, a Persian.

"On Drug Substitutes and What Takes Their Place.[1]" This is one of the earliest treatises in the Arabic medical literature.

Another treatise, based on the same literary model, was written by al-Rāzī. It is called "Small Treatise by al-Rāzī on Substitutes for Drugs.[2]"

Al-Rāzī's treatise states that Ḥunain ibn Isḥāq is a responsible authority and that he collected material from Galen who wrote on substitutes, from Oribasius, and Paulus of Aegina.

"I saw that Ḥunain did this work on substitutes much better than the others who preceded him and until now. I believe that my book will be better and fuller and be more profitable since it will be clear to the readers. It was for this reason of writing this book that I began to collect the material in an alphabetical fashion.[3]"

When giving the remedy and then the substitute, al-Rāzī, following Galen's regulations, gives the quantity of substitute to be used in place of one part of the original. Examples will demonstrate this.

"Chapter Alif

"*Afsantīn*. Wormwood.

"Its substitute is from the maidenhair fern as it [*i.e.* in the same quantity as the wormwood]. Paulus said that its substitute is Armenian wormwood. It is to strengthen the stomach and open obstructions. Its substitute is the asarabacca in the same weight, and black myrobalan in half of its weight.

"*Ustūkhūdus*. Lavender.

"Its substitute is horehound.

"*Ushna*. Lichen.

"Its substitute is cardamom, the same in weight.

"*Asarūn*. Asarabacca.

"Its substitutes are, caraway in the same weight, and one and a half times its weight of sweet flag and one-third of its weight of amomum.[4]

[1] *Fī abdāl al-adwiya wamā yaqūm maqām ghairihā minhā*. In MS Istanbul Aya Sofya 4838.

[2] *Maqāla al-Rāzī fī abdāl al-adwiya*. In MS Istanbul Aya Sofya 3725. This is the manuscript quoted here. It is planned by the present author to publish some of the more important *abdāl* treatises shortly.

[3] MS Aya Sofya 3725, fol. 40a.

[4] MS Aya Sofya 3725, fol. 40b.

As al-Rāzī stated, it is a very neat, alphabetized list. Given are the simples in the *abjad*[1] alphabetical order, with their pharmacological uses. Ibn Māsawaih is an author much quoted in addition to the Greek physicians already mentioned. To a much lesser extent, Māsarjawaih is also quoted so that al-Rāzī must have known the former's *abdāl* work.

In connection with substitute drug texts, these were not always used with an honest purpose in mind. Al-Ruhāwī (9th cent.), in his book on medical ethics,[2] is aware of the deceit practised by charlatans:

"An apothecary of little trustworthiness may compound an expensive drug with a similar but cheap drug like the mixing of opium with barley flour and lettuce juice, scammomy with ambergris, ambergris with salt, and camphor with marble and rice. Similar examples are numerous. Some apothecaries fraudulently prepare a similarly appearing drug instead of the lawful one even though it may be harmful in effect and deceive the ill one. An example is one who gives powder of laurel bay leaf to the man who has asked for something [else], and then it proved fatal.

"The deceivers employ many kinds of frauds in preparing and compounding false remedies as remedies which I shall not enumerate. It is not wise to mention them lest the evil ones learn them. Some brought me some tabasheer which they had bought. I examined it and doubted it. I tasted it and found that it was made from alum and then understood the apothecary's cunning...

"The same is also true in substitutions for the preparation of clove, saffron, musk, and similar odoriferous substances. When the physician uses it as a drug, it causes harm to the patient, something which would not happen with the [true] perfume.

"For this reason, the physician who does not prepare the remedy with the aid of skilful experts and authorized ones, should not purchase the remedy from the apothecary and perfumer, and must not treat the patient with it. How many pharmacists defraud many physicians, take from them the higher price of another remedy. and the physician is unaware of this! I saw one of them who took from a

[1] *I.e.* the order of the ancient Semitic alphabet, a, b, g, d... The Arabic alphabet is in a somewhat different order.

[2] M. Levey, *Medical Ethics of Medieval Islam with Special Reference to al-Ruhāwī's "Practical Ethics of the Physician"* (Philadelphia, 1967) fol. 65a.

physician [1] the price of the seed of caraway and lettuce, and the grain of the horseradish instead of the price of white pepper. The physician did not know this in spite of the fact that there is a great difference between them both in strength and effect. Because of the similarities in juices and in gums, there is frequent and fraudulent substitution. Many sick have perished because of the ignorance of the physician and the irreligiousness of the pharmacist. These and similar matters occur with the simple remedies. The physician must beware of every kind of fraud."

Later, fraudulent operations by pharmacists eventually led to a system of checks in some large cities by Islamic rulers. They appointed overseers for this and other areas of private business where the public interest was vitally concerned.[2]

Among the most valuable treatises which discuss drugs and material relevant to them are those on the subject of agriculture. In a major work, ibn al-Waḥshīya discusses in full what he considered as Nabatean agriculture. His work, in fact, is entitled, "Book on Nabatean Agriculture,[3]" giving much data from the Greek sources and from his own valuable experience.

In the twelfth century ibn al-'Awwām wrote his "Book on Agriculture,[4]" much of it from Greek sources : another important Arabic author on the same subject is ibn al-Baṣṣāl (end of 11th cent.) of Toledo; his book is called "Book on Agriculture.[5]" It is full of material on cultivation of plants and trees, pharmacological data, and items of great interest in botany. A small section reads :

"Cultivation of the lentil

"The lentil is similar to wheat in its cultivation and in working of the earth. This is that wheat does not grow as the best and bountiful except with careful tilling; then it is good. The lentil is an early crop

[1] *Ibid.*, fol. 65b.

[2] For commercial law and pharmacy, *cf.* M. Levey, *Chymia 9*, 19-26 (1964).

[3] *Kitāb al-filāḥa al-nabatīya* in MS Paris B.N. 2803 Arabic.

[4] *Kitāb al-filāḥa.* ed, by J.A. Banqueri, *Libro de agricultura* (Madrid, 1802) 2 vols.

[5] *Kitāb al-filāḥa. Cf.* also the *'Umdat al-ṭabīb fī ma'rifat al-nabāt l'kull labīb* of an anonymous author, and ed. by Asín Palacios, *Glosario de voces romances registradas por un botánico anónimo hispano-musulmán* (Madrid, 1943) (siglos xi-xii); Spanish translation of "Tratado de Agricultura" of ibn Wāfis in *Al-Andalus VIII* (1943); "Tratado de Agricultura" de ibn Baṣṣāl in *ibid., XIII* (1948).

as is wheat about the same time. If it is not so, it is given water. Since it sprouts in the earth when given water, this would make it come up in the month of February. The earlier the better. The seeds are fawn colored except when they have been from the garden, according to the description. It is according to the work one puts into it, if God wills. Know that the bean, vetch, termus, and sweet pea make the earth good... and do not make it sour.[1]"

Not only are the different types of technological treatises of value for the study of early medieval pharmacology but there are also many books and many as yet unedited manuscripts on chemistry, botany, zoology, and medicine.[2] These will surely make a contribution to these studies when they will be edited and translated.

An example of a geographer having botanical interests has been given above. Encyclopedists always devote parts of their works to animals, plants, and minerals. The best known is the treatise of Zakarīyā al-Qazwīnī (1203-1283), composed of two parts, "Marvels and Singularities of Creatures" and "Marvels of Countries.[3]"

[1] J.M. Millās Vallicrosa and M. Aziman, *Ibn Baṣṣāl Libro de Agricultura (Kitāb al-filāḥa* (Tetuan, 1955) pp. 112-113 Arabic.

[2] *Cf.* such books as al-Damīri's (1344-1405) *Ḥayāt al-ḥayawān*, "Lives of Animals" (Cairo, 1958); al-Idrīsi's (1099-1166). *Kitāb al-jāmi'*, "The Universal Collection," a work on botany and pharmacology (in Instanbul only half is extant in MS Fatih 3610), and Jābir's and other early and later chemists' works. The later works are often useful in extrapolating the information backward for a clearer understanding of early texts.

[3] The former is *'Ajā'ib al-makhlūqāt wa-gharā'ib al-maujūdhāt;* the latter is *'Ajā'ib al-buldān. Cf.* edition by F. Wuestenfled Göttingen, (1848-1849) 2 vols. There are other editions of the "Cosmography."

CHAPTER TEN

INFLUENCE OF MUSLIM WORK

In the twelfth century, Islamic pharmacology and its associated sciences began to go down in quality, both in the East and West. There were exceptions, some of which have been mentioned in this book. One of these was ibn al-Baiṭār who cited more than 150 authors, mostly al-Rāzī, ibn Sīnā, al-Ghāfiqī, al-Idrīsī, Dioscorides, Galen and al-Dīnawarī. In 2,330 paragraphs, he wrote about 1,400 simples. The same author also wrote another volume, "The Sufficient Book,[1]" divided into twenty chapters and concerned with simples which are proper for different ailments.

Ibn Rasūl (d. 1296), of Yemen, wrote a very useful book on simple drugs, arranged alphabetically. At the end, it has a list of synonyms. It is called "Trustworthy Book.[2]"

Kūhīn al-ʿAṭṭār has already been mentioned. In twenty-five chapters, he discussed many facets of pharmacology and remedies. His *Minhāj al-dukkān* discussed direction of the apothecary shop, and was written in 1295 in Cairo. It is still used by practitioners and pharmacists in the Near East and has come out in many editions.[3]

Another work, also by a Cairo authority, al-Anṭākī (d. 1599) must be mentioned because of its popularity in the Near East. It is "Memorandum for Intelligent People." It contains much diverse material but is primarily an alphabetical list of drugs.[4]

Many other pharmacological writers took some part in the Arabic contributions to this field but they cannot all be mentioned. They contributed in various ways to the diffusion of pharmacological knowledge.

In the thirteenth century, the incursions of the Mongols put an end, in most of the Near East, to scientific writing. It was only toward

[1] *Kitāb al-mughnī fī al-adwiya al-mufrada*, MSS Paris 5777, 6623.

[2] *Kitāb al-muʿtamad* (Cairo, 1951) ed. Muṣṭafā al-Saqā.

[3] *Minhāj al-dukkān* (Cairo, 1940).

[4] *Tadhkirat uli al-albābwajāmiʿ al-ʿajab al-ʿujāb* (Cairo, 1952). *Cf.* M. Meyerhof, *Al-Andalus 3*, 32-41 (1935).

the end of the century that the new rulers encouraged work in medicine but it was then too late to bring back the Golden Age which had lasted from about 800 to about 1100. In the West, Arabic culture also suffered reverses as political fortunes ebbed.

However, in Spain, Salerno, and North Africa, about the end of the eleventh century, many Westerners were to be found in an intense search to procure the highest elements of Islamic science and culture. To this end, just as at the beginning of Arabic striving for a higher civilization when Ḥunain and others translated from Syriac, Greek, Sanskrit, and Persian into Arabic, so did the Europeans make enormous efforts to carry over the Arabic into Latin. At this time, only traces of Greek science were possessed by Latin writers and scholars.[1]

From 1070 to 1087, Constantine the African translated, from Arabic into a barbarous Latin, many Arabic texts on science. Working first at Salerno, then at Monte Cassino, he turned into Latin such works as Hippocrates' "Aphorisms" from Ḥunain's Arabic version, Ḥunain's "The Ten treatises on the Eye," many works of Galen and Hippocrates, and also those of ʿAlī ibn ʿAbbās (Haly Abbas), Isḥāq al-Isrāʿīlī (Isaac Isreali), and al-Rāzī (Rhazes).

In Christendom, in the eleventh century, there was a ferment partly due to the struggle with the Muslims in Spain and Sicily. When Toledo, the great Muslim center of learning, fell in 1085 to the Christians, the latter flocked there to behold the remains of Moorish civilization. This intensified the work of translation into Latin. Many polyglot Jews remained in that part of Spain which had been conquered by the Christians and so it was that these earlier residents who often knew Latin, Hebrew, Arabic, and Spanish, frequently played a major role in the task of translation from the Arabic and the transmission of science and philosophy to European scholars.

Collaborative efforts of Jews and Christians in translation led to impressive achievements in Latinizing many mathematical, astronomical, chemical, medical, and other works. Such directors as Dominico Gundisalvi, Gerard of Cremona, and Mark, all working in Toledo, were highly effective and attempted to maintain a high standard. In Sicily, the same ferment and activity took place, particularly in the eleventh

[1] M. Meyerhof, "Science and Medicine" chapter in *The Legacy of Islam*, ed. by T. Arnold and A. Guillaume (London, 1952).

and twelfth centuries, and continued at a lesser pace until the sixteenth century.

Arabic pharmacology survived until the beginning of the nineteenth century.[1] Even today the Greco-Arabic Yunani tradition is in practice among more than 100 million people in the Middle East not only in popular and folklore medicine but is also taught in Yunani and Ayurvedic medical colleges in India and Pakistan. From Morocco to India, druggists in smaller towns compound their remedies according to the ancient classical traditions of a thousand years ago.[2]

In this final chapter, it is now necessary to turn back to the development of Arabic pharmacology in the period from the eighth century to the eleventh century. For a true picture, it is essential ro rely on the texts themselves.

In the ninth century, the influence of Indian and Persian medicine, in the al-Kindī and ibn al-Waḥshīya texts, was already strong. This is particularly true in regard to the simples employed but with respect to theory, the Greeks were overwhelmingly favored.[3] The Greeks, as Dioscorides and the later Galen, were admired by Muslim pharmacological authors for the orderly and objective approach in their respective works. As a result, much of Arabic pharmacological work is based upon this practical outlook. Thus almost all Muslim books in this area are devoid of most of the supernatural and more subjective practices of other fields which came to be recognized as the pseudosciences of alchemy, astrology, numerology, and others, some of which had originated in ancient Mesopotamia. In the work of ibn al-Waḥshīya, a more subjective approach led to his lack of influence on those who followed in toxicology.

The same practical factor was applied to all Arabic medicine. Al-Majūsī wrote that "the student of medicine should constantly attend the hospitals and sickhouses, pay unremitting attention to the circumstances and conditions of their inmates in company with the most acute professors of medicine.[1]"

In quantity, the number of simples and compound remedies rose to about 4,000 in the later works. This is a fantastic number when compared with the mere hundreds in the Greek works. The Muslims kept up a constant attempt to develop their materia medica quantitatively. Many new chemicals became better known as alchemical works and particularly the processes of chemical technology developed. The latter included dyeing, metallurgy of silver, gold, copper, iron, lead, tin and others, tanning, manufacture of inks, paper, and many other products. Methods of procuring chemicals and their necessary purification had to be improved. Thus, those whose work led to perfumery and distillatory operations learned to provide more suitable raw material for the apothecary and physician. In the early Muslim period, pharmacology was the mother of much of chemistry. In this way, the Muslims provided many basic data regarding chemicals and their physical and chemical properties and reactions. This process of elaboration was carried on by the Latin scholars until the breakthrough in chemistry a few hundred years ago.

Not only did the literature of simples grow but the compound prescriptions rose in number in the later *aqrābādhīns*. The former led to the latter. With very little change, this material led to the development of pharmacopoeias in the modern European languages.

Partly because of the greater development of practicality in pharmacology, the Muslims were forced to describe their remedies in many types of literary models. The tables of ibn Biklārish are a case in point. He compiled them to ease the task for a medical practitioner to hunt up a simple to obtain its Galenic and other properties in brief form. Everything essential was included for the average physician. Although, however, this type of text was of value for a time in including more and more simples, it and many other model texts tended to become rigid, did not allow for the unusual simple which did not fit into table form. As a result, various types of literary models were no longer useful and disappeared from use a few hundred years after ibn Biklārish.

Some words should be said about the actual value of the Arabic

[1] *Cf.* M. Meyerhof, *ibid.*, p. 353.

[2] *Cf.* E.G. Browne, *Arabian Medicine;* G. Bergsträsser, *Ḥunain ibn Isḥāq ueber die syrischen und arabischen Galen-uebersetzungen;* D. Campbell, *Arabian Medicine and Its Influence in the Middle Ages*, vol. 1; J. Hirschberg, *Die arabischen Augenärzte* (Berlin, 1904-05) 2 vols.

[3] As to the period when Hippocrates and his followers lived, it is outside the scope of this book to determine if the original ideas were of Hindu or Greek origin.

[1] Quoted from E.G. Browne, *Arabian Medicine*, p. 56; M. Z. Siddīqī, *Studies in Arabic and Persian Medical Literature* (Calcutta, 1959) p. 114.

simples in therapy. Most of them have no real therapeutic value. Some may still be used as styptics, astringents, desiccatives, and for other obvious reasons. For example, many of the Arabic remedies are still used even in Western Europe and the United States and are called folklore remedies. The use of Yunani remedies in Pakistan, India, and elsewhere, has been discussed earlier. Furthermore, as in Arabic medicine, many drugs are being used in modern medical therapy with only a very meager knowledge of their chemical reactions in the body or of their gross effects.

There is one other factor, a subjective one, which has not been mentioned. This element concerns the human equation in the administration of drugs. The early medieval Arabic practitioner considered the patient as a whole and tried to take care of the sick person's psychological needs in therapy. It was also of importance that the patient have confidence in the physician. In Yunani medicine, these non-objective but nevertheless real circumstances are carefully considered and much time is given over to them. It may be seen that certain areas of pharmacology were affected in the dosage and taste of the remedies, the comfort of the patient thereafter, and in other elements which were carefully considered.[1]

Muslim pharmacology, therefore, when discussed by itself without much reference to other aspects of medicine does not yield a complete picture of this area. It is only when it is taken as an integral part of the whole of medical practice that it may be seen in its true perspective. In the Arab world, pharmacological studies were well ahead of the rest of medical practice and remained that way in the West for a long time afterward.

Today, many of the originally Arabic names are in modern language as *nāranj*, orange; *kāfūr*, camphor; *kabbar*, caper; *misk*, musk; *al-kākanj*, alkekenge; *za'farān*, saffron; *summāq*, sumac.

Traces of words and entire phrases from the Arabic may frequently be found in Spanish and Portuguese of the twelfth century and later. Berber was also affected in this way, so that the language is heavily laden with Arabic names of botanicals and minerals.[2]

Throughout this book, various types of Arabic pharmacological

[1] For psychosomatic elements in medical practice, *cf.* M. Levey, *The Medical Ethics of Medieval Islam.*

[2] *Cf.* M. Meyerhof, *Al-Andalus 3*, 40-41 (1935).

works have been shown to have been translated into the Latin. These are mentioned in association with the treatment of the original Arabic works.

Many Latin pharmacological works, largely dependent on Arabic texts were not translations but compilations, and some were improvements. Some of these which came mainly from Arabic writings and also showed Greek influence were such as the *Expositio supra Nicolai antidotarium* written by Johannes of St. Awand, a canon and doctor in Tournay, about 1250. It was published in Venice in 1495, then later in 1589 and 1602. Others are *Conciliator* and *De venenorum remediis* by Peter of Abano (1250-1230) who was a professor in Padua from 1306 to 1314. It was printed in Rome in 1475 and 1643. Much of these was taken from ibn Rushd and Mesue.[1]

Reflecting a superior knowledge of Galen's and abū al-Qāsim's works, Simon de Cordo Januensis (Genoa), physician to Pope Nicholas IV (d. 1292), wrote *Synonyma mediciana.* This was published in Parma 1473, Padua 1474, Venedig 1514, and Lyon 1534.

Giacomo de Dondid (b. 1298) was a professor in Padua and wrote in 1355 the pharmacological compilation, *Promptuarium Medicinae.* It was later published in Venice in 1481, 1543, and 1576. He also wrote *Herbolarium sive Aggregator practicus de Simplicibus* which was published later with many botanical woodcuts in Mainz 1485, Passow 1485, 1486, and Venice 1499, and showed Arabic influence.

Aldobrandinus de Garbo (d. 1327), a nephew of Thadaeus, was a professor at Bologna, Siena, and Florence. *De emplastris et unguentis* was one of his works devoted to exposition of ibn Sīnā's medical treatises.

Gentilis da Fuligno, known as Fuligineus (d. 1348), was a son of a physician of Bologna and a pupil of Thadaeus Florentinus. He was a physician to Count Ubertino of Carrara and also a professor in Padua and Perugia. Influenced by the Arabs, he wrote on ibn Sīnā and also on Galen. His treatise, *De praeparatione medicinarum et de modo investigandi complexiones earum* was published, Venetiis 1568.[2]

An important work on pharmacy in the modern sense was much influenced by the Arabic treatises of Avicenna (ibn Sīnā), Serapion

[1] H. Schelenz, *Geschichte der Pharmazie* (Berlin, 1904) p. 329.

[2] *Cf.* J.F. Gmelin, *Geschichte der Chemie* (Goettingen, 1797) 1, 76.

(ibn Sarābiyūn), abū al-Qāsim (his *Liber Servitoris)*, and Mesue (ibn Māsawaih). It was written by Saladin of Ascolo (probably Puglia) in the middle of the fifteenth century and called *Compendium aromatariorum*, first published Bononiae 1488. Saladin was a well known physician in Salerno. In seven parts, the work gives the examination of the pharmacist, the qualities desired of the pharmacist, writings which should be studied by the pharmacist, substitute drugs, rules for gathering botanicals according to the calendar, care of simples and compounded drugs, and vessels for storage of drugs. Much of it is from the Arabic mentioned both in form and contents.

In the fifteenth century, there appeared treatises on pharmacology and pharmacy in the vernacular. The prototype of a new class of works in this field was the Italian work, *Nuovo Receptario Composto Dal Famossisimo Chollegio Degli Eximii Doctori Della Arte Et Medicina Della Inclita Cipta Di Firenze*, "New Formulary Compiled by the Most Renowned College of the Distinguished Doctors of Art and Medicine of the Magnificent City of Florence," published in two varients in Florence, January 10th and 21st, 1498 (modern date 1499).[1]

This first European official pharmacopoeia was written by Ludovico dal Pozzo Toscanelli, a physician of Florence, who was authorized to do so by the Florentine College of Physicians. The second edition was called *Ricettario Del Arte, Et Universitate De Medici, Et Spetiali Della Citta Di Firenze*, Florence 1550. Various other editions followed.

Primarily a compilation, this work, which influenced European pharmacopoeias greatly, contains material from Arabic treatises on the simples, substitutes, preservation of drugs, compounding of drugs, prescriptions, practicum of pharmacists, and a list of little known drugs, among many other data reminiscent of Arabic pharmacology discussed in earlier chapters. The Arabic work, *Minhāj al-Dukkān*, discussed earlier as the work of a thirteenth century Jew, influenced this Italian treatise greatly.[2]

It was in this manner that pharmacopoeias in the vernaculars of

[1] The text used is British Museum 606, one of the two variants known of the first edition.

[2] Alfons Lutz, "Studien über die pharmazeutische Inkunabel 'Nuovo Receptario' von Florenz," *Veröffentlichungen der Internationalen Gesellschaft für Geschichte der Pharmazie* N.F. *13*, 113-128 (1958); Geo. Urdang, "Pharmacopoeias as Witnesses of World History," *J. Hist. Med. and Allied Sciences 1*, 46-70 (1946).

German, French, English, and Spanish evolved, all showing the Arabic influence.[1] A later edition of the London Dispensatory, 1691, shows this influence in its list of botanicals, simples, minerals, and animal substances in alphabetic order, their Galenic natures and grades, compounded drugs for internal and external use in the form of elixirs, preserves, sugars, powders, electuaries, troches, oils, pills, cataplasms, clysters, lotions, and others all reminiscent of the Arabic works. Only some of the last part on the newer practices of chemistry would have been novel to the Arabs. Most of the Arabic material was constantly repeated until the beginning of the nineteenth century. There is much to be learned yet from the early drug treatises.

[1] R. Folch Andreu, "Influsso Italiano sull' evoluzione della farmacia," *Raccolta di scritti in onore di Guilio Conci a cura di A.E. Vitolo* (Pisa, 1953) pp. 167-177.

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